FIELD CROP ABSTRACTS

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REVIEW ARTICLE

PLANT POPULATION AND CROP YIELD : PART II

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Yield and plant population in British crops (continued)

POTATOES

The potato crop differs from those considered in Part I in that the yield is a product of vegetative growth. The grower usually considers the crop yield in terms of the total tonnage and the tonnage of tubers of ware size produced. In most cases the yield of ware is the most important criterion in determining the financial returns from the crop. Ware size minima are established by the Potato Marketing Board and these are increased in seasons of overproduction. Agronomically the yield may be considered to be made up of the number of plants per unit area, the mean weight of tubers per plant and the proportion of tubers reaching the ware size standard.

In this crop the unit of plant population needs definition. Several workers (Bates, 1935 ; Jones, 1946 ; Singh, 1952 ; Davies, 1954 ; Toosey, 1958) have emphasised that the unit of population is the individual sprout which grows from the seed tuber to produce an independent plant. Each seed tuber position in the planting pattern adopted is referred to as a "hill" and each hill will normally produce more than one true plant. Thus the true plant population is neither the number nor the weight of seed tubers planted, but rather the product of the number of seed tubers and the mean number of sprouts developed per tuber. There is limited information on these matters in many of the plant-population or seed-rate experiments published. In any one experiment a variation in either the number of tubers planted or the size of tubers used, each of which will affect the weight of seed planted, will give rise to differing true plant populations. As variety, tuber size and tuber treatment will each affect the number of sprouts developed, it is not possible in most cases to compare different experiments on the basis of the true populations.

In spite of these limitations, the weight of seed used is an important consideration to the farmer. It has been shown by a number of workers (Bates, 1955 ; Findlay and Sykes, 1938 ; Tinley and Bryant, 1939 ; Jones, 1946 ; Singh, 1952 ; Davies, 1954 ; Montague and Ivins, 1955 ; Saunt, 1960) that an increase in the weight of seed used has a differing effect upon total yield compared with the yield of ware. Davies' (1954) data is used in Fig. 2 to show this difference. It will be seen that whereas the total yield follows the asymptotic curve mentioned above, the ware yield, and in particular the large-sized ware, show a point of inversion in the yield/seed weight relation. An examination of the published data indicates that the reciprocal of the coefficient of multiplication, in the case of total yield, is linearly related to the weight of seed planted. Similarly for each published experiment the number of seed tubers (x) divided by yield is linearly related to the number of tubers,

$$\text{i.e. } \frac{1}{M} = \frac{s}{y} = a + bs$$

$$\text{also } \frac{x}{y} = a + bx$$

An examination of ware yields by the same technique reveals a curved relationship of a similar nature to that obtained for cereals and pulse crops.

Boyd and Lessells (1954) used a different technique for summarising the published information on weight of seed and crop yield. Using semi-log paper they graphed the simple yield figures against the log of the weight of seed planted. This device enabled the asymptotic curve of total yield to be transformed into an approximate linear relation. Linear regressions of the form given below were fitted and the mean value of the constant b was obtained.

$$Ys = Yo + b\,(\log S - \log So)$$

(where S = seed rate in tons/acre,
So = standard seed rate,
Ys = yield at seed rate S,
Yo = yield at seed rate So,
b = regression constant).

Although the author claims that the $1/M$ technique is theoretically more acceptable, an examination of 15 individual experiments (some used in Boyd and Lessells paper and some published since) by both techniques shows that there is no material difference in the curvature of the mean seed rate/total yield curve. The values of b obtained by Boyd and Lessells were 5·03 where the seed spacing was varied and 4·29 where the seed

tuber size was varied. Allowing for other and more recently published data (Jones, 1946 ; Singh, 1952 ; Montague and Ivins, 1955 ; Saunt, 1960) the value of b for spacing differences only, needs revising to 5·34.

Having obtained the mean yield for total yield, Boyd and Lessells went on to examine the relation between seed rate and percentage ware, or rather the percentage of seed plus chats. In this case the data were transformed to an approximate linear form by graphing both the seed rate and the percentage of seed plus chats on the log scales. This gave rise to a series of linear regressions of the form :

$$\log (100 - Ws) = \log (100 - Wo) + b_2 (\log S - \log So)$$

(where Ws = ware % at seed rate S,
Wo = ware % at seed rate So,
b_2 = the regression constant).

Again the mean values of b_2 were calculated and these were 0·56 where spacing was varied and 0·25 where seed size was varied.

From these 2 equations it is therefore possible to calculate the yield of ware. Boyd and Lessells summarised data are shown in Table 11. The values for total yield and percentage ware are the means for both alteration in seed size and tuber spacing.

Table 11. Potatoes : weight of seed planted and yield

(mean data from all experiments, using mean value of seed size and seed spacing regressions)

Seed rate (S) (tons/acre)	0·25	0·50	0·75	1·00	1·25	1·50	1·75	2·00
Total yield (tons/acre)	8·1	9·2	10·0	10·6	11·2	11·6	11·9	12·0
% Ware > 1·5–1·75 in.	95·8	94·5	93·5	92·8	92·2	91·6	91·0	90·5
Ware yield (tons/acre)	7·7	8·7	9·4	9·9	10·3	10·6	10·8	10·9
Seed + chats (tons/acre)	0·4	0·5	0·6	0·7	0·9	1·0	1·1	1·1

From the data in Table 11 Boyd and Lessells made an estimate of the most economical seed rate. Their method was not dissimilar from the " net yield " technique used with the cereal and pulse crops (see Part I). The main difference was that an allowance was made for the extra costs involved in lifting, clamping and sorting of the extra total yield obtained from the higher seed rates. Assuming ware values at £12 per ton, seed plus chat values of £6 per ton and seed costs of £12, £18 and £24 (i.e. 1×, 1·5×, and 2× ware price) the financial returns given in Table 12 can be calculated.

Table 12. Potatoes : seed rates for economic maxima

Seed rate (S) (tons/acre)	0·25	0·50	0·75	1·00	1·25	1·50	1·75	2·00
	£	£	£	£	£	£	£	£
Value of ware	92·6	104·2	112·3	118·2	123·7	127·4	129·0	130·3
Value of seed + chats	2·4	3·0	3·6	4·2	5·4	6·0	6·6	6·6
Total value of crop	95·0	107·2	115·9	122·4	129·1	133·4	135·6	136·9
Cost of clamping, lifting, sorting total crop	16·1	18·4	20·0	21·2	22·4	23·2	23·8	24·0
Value of crop less lifting, etc.	78·9	88·8	95·9	101·2	106·7	110·2	111·8	112·9
Price of seed £12	3·0	6·0	9·0	12·0	15·0	18·0	21·0	24·0
Net return	75·9	82·8	86·9	89·2	91·7	**92·2**	90·8	88·9
Price of seed £18	4·5	9·0	13·5	18·0	22·5	27·0	31·5	36·0
Net return	74·4	79·8	82·4	83·2	**84·2**	83·2	80·3	76·9
Price of seed £24	6·0	12·0	18·0	24·0	30·0	36·0	42·0	48·0
Net return	72·9	76·8	**77·9**	77·2	76·7	74·2	69·8	64·9

The figures in heavy type indicate the maximum economic return for each assumed price of seed. As Boyd and Lessells point out, however, further deductions should be made from the net returns in order to allow for the cost of planting larger quantities of seed. They set the economic optima, where the cost of seed planted is £20 per ton, at 0·75 ton per acre.

The calculations made above are based upon ware grades of 1·5 in. – 1·75 in. For this grade of ware, Boyd and Lessells showed that it made no difference whether the various seed rates were obtained by varying the tuber spacings at a constant tuber weight, or by varying the tuber size at constant tuber spacings. This feature did not apply in the case of total yield or the yield of larger sized

ware. With total yield, varying the spacing had a greater effect than varying the tuber size : the reverse was true with ware grades of 2 in. The explanation of this difference lies in the relation between seed tuber size and spacing upon the true plant population. Table 13 shows that although the sprout number increases with the larger seed tubers this increase is not in proportion to the increase in tuber weight. Thus with larger seed tubers there is a larger weight of parent tuber per sprout.

Table 13. Potatoes : size of seed tuber, sprout number and weight of tuber per sprout

	Bates, 1935 (King Edward)			Toosey, 1960 (King Edward)			Saunt, 1960 (King Edward)	
Seed tuber wt. oz. ..	1·0	1·5	2·5	1·25	1·5	2·25	1·06	7·17
Sprout No.	2·82	3·37	4·55	2·63	3·32	4·26	2·15	5·40
Tuber wt./Sprout No. ..	0·354	0·445	0·550	0·475	0·452	0·528	0·492	1·330

Increasing the weight of seed planted by increasing the seed size will therefore give rise to a smaller true plant population than equal increases in weight planted brought about by increasing the number of seed tubers. These features have two opposite effects upon total yield. With increase in seed size the greater weight of parent tuber makes for a more rapid early growth of the individual shoot (Jones, 1946 ; Singh, 1952) ; the smaller number of true plants developed from the larger tubers will on the other hand retard the development of a full leaf cover and hence give less efficient use of radiant energy for photosynthesis (Saunt, 1960). It is evident from Boyd and Lessells' data that the latter factor predominates over the former in terms of total yield. In the case of ware yield the number of developing tubers, to which synthesised products are translocated, is of importance. The number of developing tubers is related to shoot number and thus will be greater where seed rate is increased by increasing the number of seed compared with increasing the size of seed.

The general conclusion to be drawn from the above is that for high ware yields a combination of large size of seed tuber but low number of shoots per tuber is required. The importance of this has been emphasised with early potatoes by Thomas and Eyre (1951) and for main crops by Toosey (1958). Toosey (1959) has shown that this can be brought about by very early chitting (i.e. as soon as the crop is lifted) of the seed.

Variety enters into this matter since of the 2 most important main-crop varieties Majestic and King Edward (with its variant Red King), the former produces a smaller number of tubers per hill than the latter (Montague, 1956). The effect of this upon total yield and large-sized ware (>2 in.) yield is shown by Montague (1956) and the results are extracted in Table 14.

Table 14. Majestic and King Edward reaction to plant population

Seed-tuber population/acre		6050	7500	9400	12000	18900
Total yield : (tons/acre)	King Edward	10·96	10·77	11·05	11·60	13·06
	Majestic	10·68	11·50	11·05	11·60	12·87
Ware>2 in. (tons/acre)	King Edward	8·03	7·76	7·49	7·21	6·66
	Majestic	8·95	9·31	9·13	8·95	9·86

It is evident that this difference exhibited by the 2 varieties is of great important in practice as shown by the check-weighings carried out between 1955 and 1958 by the Potato Marketing Board (1958). Here it was shown that whilst total yields of the crop were only slightly in favour of Majestic, the ware yields and particularly the large-sized grade ware yields, were substantially in favour of Majestic. Thus the technique of very early chitting mentioned above would appear to be of much greater importance with King Edward and other varieties which produce a high tuber number per hill.

In the potato crop planting pattern or irregularity of planting within a theoretical pattern, would appear to have a small effect compared with the population effect. Three years' work at Leeds University (Saunt, 1960), showed that there was no significant difference in total or ware yield from planting in 28-in. rows compared with square-planting over populations extending from 8000 to 32,000 seed tubers per acre. Davies (1954) in a 3-year series of experiments showed that it was only at very low seed populations where very pronounced irregularity of spacing showed yield decreases compared with the same population at uniform spacing. The yield of ware (>1·75 in.) was not affected by the irregularity even at low populations.

SUGAR-BEET

A great deal of experimental work on plant-populations has been carried out on the sugar-beet crop in Gt Britain, Europe and in the

USA. In general the yield/plant population relation has conformed to the asymptotic type mentioned above. The widest range of populations covered has been from 10,000 to 100,000 plants per acre in 2-year experiments in Belgium (Decoux, 1945). In one year there was no evidence of a yield decrease of washed roots or sugar per acre at 100,000 plants per acre but in the other year there was some evidence of decrease. Dutch work (de Haan and Klijnhout, 1931) and Czech work (Soucek, 1922) showed no decrease up to populations of 40,000 plants per acre.

Work carried out in Gt Britain has covered a rather narrower range of populations. Hunter-Smith and Rhys-Williams (1927), in their "Census of an acre of roots" showed that yield per acre increased asymptotically with an increase of plant population up to 29 $\times$ 10^3 plants per acre resulting from a decrease in plant spacing within a 22-in. row. Engledow *et al.* (1928) using a similar technique obtained similar results. Davies and Dudley (1929) showed an increase of yield of beet singled to 10 in. within the row, where the row width was reduced from 24 in. to 21 in. and from 21 in. to 18 in., corresponding to plant populations of 25·6, 29·2 and 34·1 $\times$ 10^3 plants per acre. A decrease to 15 in., corresponding to 41·0 $\times$ 10^3 plants per acre gave no further increase, however. Decreasing the singling distance to less than 10 in. also gave no increased yield. The results of Davies and Dudley were confirmed by Garner and Sanders (1939) at Cambridge. Row widths of less than 18 in. and singling distances of less than 10 in. or in fact 12 in. (equivalent to 34 and 29 $\times$ 10^3 plants per acre, respectively) did not give appreciable increases in crop yield. Garner and Sanders found a small increase in the percentage of sugar at the higher plant populations. Work at Rothamsted (1933) also showed that the percentage of sugar increased at high plant populations and particularly where the row width was reduced to 15 in. and below.

The most extensive work on sugar-beet plant populations has been carried out at the Norfolk Agricultural Station, Sprowston. Most of this work is summarised in Bulletin No. 153 of the Ministry of Agriculture and Fisheries (1953). So far as spacing of plants within the row is concerned, out of 8 experiments reported none gave any yield increase whilst 2 gave slight decreases of yield at spacings of less than 10 in. There was in fact little to be gained in yield with plant spacings of less than 11·5 in. On the other hand, increasing the plant population by decreasing the width between rows had an appreciable effect upon both the yield of washed roots and the yield of sugar. The mean results of 15 experiments carried out over 5 years on 3 soil types are given in Table 15.

Table 15. Sugar-beet : plant population and yield

(mean results from 15 experiments, 3 soil types $\times$ 5 years)

11·5 in. spacing on row widths of in.	Equivalent plant population 000's/acre	Yield of washed roots tons/acre	Sugar %	Yield of sugar tons/acre	Singling, seconding and lifting relative man-hr.*
25	22·1	12·9	16·3	2·10	100
20	26·4	13·9	16·5	2·30	115
15	37·0	14·3	16·7	2·38	145

*Mean of 3 years at one centre

The increase of plants from 22·1 to 26·4 $\times$ 10^3 per acre gave an increase of 1·0 ton of washed beet per acre, whilst a further increase to 37·0 $\times$ 10^3 plants per acre gave an increased yield of 0·4 tons of washed beet. One of the soil types used in this series of experiments was a highly productive black fen. There was evidence that this soil showed a smaller response to high plant populations than the other two. This is one piece of evidence amongst others that gives rise to Rayns' suggestion (Ministry of Agriculture and Fisheries, 1953) that lower-fertility soils, or drier regions, require higher plant populations to attain full potential yield.

More recently Harvey (1957) has published data on the effect of leaving double plants in normal row-width and spacing patterns. His results showed that up to 20% doubles had no effect upon yield but above 50% there was an appreciable decrease in yield. This finding together with the yield decrease in two of the singling-distance experiments mentioned above throws doubt on whether the yield/plant population curve is truly asymptotic in this crop. Further, when the data from the row-spacing experiments summarised above are examined by the x/y technique the relation departs somewhat from the linear. It should be realised however that the linearity of the $x/y : x$ regression applies strictly to dry matter yields. The yield of sugar-beet is of course expressed in terms of washed beet and percentage of sugar, not in terms of dry matter.

In considering the economics of plant populations with this crop, the increased labour required in handling crops grown at high populations, achieved by narrower row-widths, is an important matter. Narrow rows mean an increased length

of row per unit area. Singling, seconding and lifting are each influenced by the length of row to be dealt with rather than by the area of land. Relative figures obtained by workers at Sprowston are given in Table 15. Rayns' general conclusions (Ministry of Agriculture and Fisheries, 1953) taking both yields and costs into account are that a population of 30×10^3 plants per acre is about the ideal, and can reasonably be achieved on row-spacings of 18 in.–22 in. and at singling distances of 11 in.–9 in. It is to be noted, however, that if the modern techniques of precision drilling, mechanical thinning and mechanical harvesting can decrease the handling costs of higher populations, it may well be in the future that populations somewhat greater than 30×10^3 plants may be an ideal to aim for.

FODDER-BEET AND MANGELS

In a similar study to that on sugar-beet, Hunter-Smith and Rhys-Williams (1927) found that yield per acre increased with larger plant populations due to decreases in plant spacing within a 22 in. row. Watson and Russell (1943), at Rothamsted, also showed with mangels that a 28% increase in the plant population attained by narrowing the row-width from 26 in. to 20 in. gave 11% increase in dry matter yield. Finney (1941), summarising some 2300 Danish experiments carried out by Pedersen during 1926–30, indicated that above 20×10^3 plants per acre, yield increases were only small and there was some indication of a maximum yield at 32×10^3 plants per acre.

More recently the results from a Dutch series of experiments on fodder-beet have been published in English by Boyle (1952). The original work was published by Dillewijn and Smeenk (1944). The main points are extracted in Table 16. The variety used was mainly the fodder sugar-beet variety Groeningia, but in one year a Barres-type mangel (Productiva) was used in addition. In this data the ratio x/y, where y is the yield of dry matter,

Table 16. Fodder-beet : plant population and yield

(results from Dutch experiments)

(x) Plant pop. in 000's/acre	20·2	24·3	28·3	30·4	36·4
Fresh yield tons/acre	32·5	33·7	34·6	35·2	35·6
(y) Dry matter yield tons/acre	4·64	4·92	5·20	5·23	5·34
Dry matter %	14·3	14·6	14·7	14·9	15·0

is very close to linearity with x. Attention is drawn to the increasing dry matter percentage associated with increasing plant population. Other workers have drawn attention to the same feature.

In one of the years (1939) the experiments were divided into groups according to soil fertility. There was very clear indication that the lower fertility soils required higher plant populations to reach the full yield potential of the site compared with the better-yielding soils. This confirms the conclusions reached by Rayns with the sugar-beet crop and it contrasts with the results obtained with cereals discussed earlier. It is, however, in accordance with expectation from the vegetative yield equation given in the introduction (see Part I).

In the comparisons between the two varieties there was little difference in their reaction to plant population. Ivins and Webster (1957) also showed no significant interaction in dry matter yield between plant populations and contrasting varieties of fodder-beet and mangel.

KALE

Several workers have examined the yield/plant population relation in marrow-stemmed kale but there is less data on thousand-headed kale. Hunter-Smith and Rhys-Williams (1927), in similar work to mangels and sugar-beet, found that as the spaces between plants in the row decreased from 25 in. to 8 in. there was a substantial increase in green yield. On the other hand Cochrane and Macfarlan (1937) in an unreplicated experiment compared non-singling with singling to 9 in., 12 in., 15 in. and 18 in. on 27 in. rows. Whilst there was a decrease in green yield with singling to 18 in. compared with 12 in. and 15 in., 6 in. also gave a lower yield and the unthinned plot gave the lowest yield of all. Eight experiments on the crop were carried out at the Midland Agricultural College (Rothamsted, 1932–8) comparing thinned (at 6 in.–12 in.) with unthinned kale. Thinning showed a significant decrease of yield in 2 of these experiments ; in the remainder there were no significant differences. At Rothamsted (1932, 1933), also, thinning to 18 in. decreased crop yield compared with the unthinned crop. At Rothamsted (1933) an experiment with thousand-headed kale was also carried out. Here again thinning decreased the crop yield. Several workers report a decrease in the dry matter percentage when the crop was thinned compared with the unthinned crop (Rothamsted, 1932, 1933 ; Fagan, Phillips and Davies, 1943).

Roebuck (1959) reported a series of experiments upon marrow-stemmed and thousand-headed kale carried out at Leeds University. The summarised results are given in Tables 17 and 18.

Table 17. Marrow-stemmed kale : plant population and yield

(mean of 3 years' experiments)

Spacing Rows in.	Spacing Plants in.	Plant population $\times 10^3$/acre	Green yield tons/acre	Dry matter yield (tons/acre) Total	Leaf	Stem	Dry matter % Leaf	Stem	Crude-protein % Leaf	Stem
22	S 48*	(6·3)	(21·5)	(2·25)	1·10	(1·15)	—	—	—	—
22	S 24	11·1	26·8	2·77	1·19	1·58	12·6	9·1	21·6	13·9
22	S 12	20·5	30·1	3·07	1·23	1·84	12·4	9·2	21·1	12·3
22	B 12	62·4	31·3	3·32	1·21	2·11	12·7	9·9	19·4	11·0
22	US	110·1	29·4	3·23	1·11	2·12	12·4	10·5	19·8	9·2
11	US	200·5	30·0	3·56	1·16	2·40	13·0	11·6	17·4	7·6

B = Bunched (3 in. bunches on 12 in. centres), S = Singled, US = Unsingled.

* This treatment occurred in 2 years out of the 3 — data for the missing year were estimated from the ratios obtained in the other two.

Table 18. Thousand-headed kale : plant population and yield

(mean of 4 years' experiments)

Spacing Rows in.	Spacing Plants in.	Plant population $\times 10^3$/acre	Green yield tons/acre	Dry matter yield (tons/acre) Total	Leaf	Stem	Shoot	Dry matter % Leaf	Stem	Shoot	Crude-protein % Leaf	Stem	Shoot
22	S 24	11·5	10·8	1·66	0·55	0·54	0·57	15·1	18·7	14·7	21·0	12·9	27·7
22	S 12	20·7	11·2	1·74	0·73	0·67	0·34	16·1	18·5	14·7	21·6	13·4	28·0
22	B 12	66·1	11·6	1·91	0·87	0·88	0·16	16·3	18·8	15·2	22·1	13·1	30·3
22	US	150·2	11·9	2·01	0·93	0·98	0·10	16·5	19·6	15·2	22·0	11·2	32·8
11	US	378·5	11·7	2·04	0·91	1·07	0·06	16·6	20·4	15·3	22·1	10·4	32·0

B = Bunched (3 in. bunches on 12 in. centres), S = Singled, US = Unsingled.

It will be noticed that with both types of kale there is an increase in dry matter yield up to the highest plant population. There is a tendency for the green yield to decrease slightly at the highest plant populations, particularly in the case of marrow-stemmed kale. This difference is accounted for by the increase in the percentage of dry matter with increasing plant population. In contrast to the dry matter, the crude-protein percentage decreases with increasing plant population. The two crops behave in a similar manner so far as stem and leaf are concerned, but in the thousand-headed kale there is the yield of secondary shoot as an additional feature. This decreases whilst its protein percentage increases with increasing plant population.

Roebuck (1959) examined the dry matter yields of both types of kale by the x/y technique and linear relations with x were obtained.

RAPE

The work at Leeds University (Holliday, 1960) with this crop, extending over a period of 4 years, has given results broadly similar to those from kale. Where it was treated as a short-season crop (i.e. sown July, harvested Oct.), substantially higher plant populations were required to reach the full potential dry matter yield compared with when it was treated as a full-season crop (i.e. sown April–May and harvested Oct.). Thus low environment resources (by virtue of a short growing season) necessitated a greater plant population for their exploitation compared with the situation where greater environment resources were available. This result shows parallelism with Rayns' experience with sugar-beet and the Dutch workers' experience with fodder-beet. The work at Leeds University on this crop also showed dry-matter-yield curves of an asymptotic form ; the smaller percentage of dry matter at low populations and the high percentage at large populations, could so alter the shape of the green-material-yield curve on occasions as to make it more nearly parabolic in shape.

Conclusions

The work on the various crops outlined above falls into the 2 yield/plant population relations described in the introduction. In most cases the equation :

$$y = Ax. \frac{1}{1 + Abx}$$

provides a suitable mathematical description of the relation between dry matter yield and plant population where the yield was a product of vegetative growth. It is not claimed that the extension of this expression to :

$$y = Ax. \frac{1}{1 + Abx + Acx^2} \left(\text{or } y = As. \frac{1}{1 + Abs + Acs^2} \right)$$

to describe the relation where yield is a product of

reproductive growth is anything more than an approximation. The exact way in which reproductive yield is related to vegetative yield is obscure and needs more study.

It should also be noted that weed competition, diseases and pests can give rise to exceptions to the general relation between yield and plant population in practice. A common example of this is where a high plant population achieved by broadcasting a crop such as kale, is compared with a lower population achieved by drilling and singling. When seed is broadcast it is almost impossible to achieve the same standard of weed control as when it is drilled. In these circumstances the expected yield increase from the greater plant population can be converted into a decrease due to weed competition. This is one example of varying populations of 2 plant species in competition for the same environment resources. It is a situation which occurs in all mixed crops of which grassland is the most important example. These more complex types of yield/plant population relations need more study. Some work on this matter is being carried out at Nottingham (Aspinall and Milthorpe, 1959). Similarly an attack of a particular disease may be of greater severity in stands with a high plant population. For instance, attacks of mildew on swede turnips in 1959 tended to be more severe on crops having a high plant population. Pests on the other hand usually have more severe effects upon crops with a low plant population.

In spite of exceptions, however, there would seem to be a general relation between plant population and crop yield. One objective in this review has been to trace its form over several crops normally grown in the UK.

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The Director would be pleased to consider suitable review articles (not exceeding 4000 words) offered for publication in *Field Crop Abstracts.*

FIELD CROPS

CEREALS

WHEAT

See also Abs. 1641, 1933, 1934, 2064.

1572 Saint-Martin, D. La culture du blé dur dans le sud-ouest. [**The growing of durum wheat in south-west France.**] *Bull. tech. Inform.* 1960, No. 147, 83–7, illus.

1573 Belozerova, N. A. [**Preceding crops for spring wheat in the steppe regions of Siberia.**] [Russian] *Zemledelie (Agriculture, USSR)* 1960, **8**, No. 2, 56–9.

In the steppe and forest/steppe regions of Siberia, for crop rotations which do not include a herbage break, it is shown (by an experiment with 4 replications) that spring wheat gives good yields (figures in parentheses, kg/ha) if grown on a bare fallow (3170), or after maize (2660), sunflower (2200), or a leguminous seed crop, e.g. soyabean, (2780). A bare fallow is of value primarily for weed control.—M.H.

1574 Norfolk Agricultural Station. [**Experiments with wheat and barley.**] *Rep. Norfolk agric. Sta. 1958-9* Sprowston, 1959, 10–11.

Wheat, var. Capelle, was sown in Sept. at 1·5 bu/ac following vining peas. For barley var. Proctor, nitrogen gave best results when applied to the seed bed at rates up to 6 cwt of 15% N fertilizer/ac. The spring wheats Koga II and Svenno gave higher yields than Atle at the 3-cwt level of 15% N fertilizer application.—J.D.J.

1575 Chávez, R. S. and Laird, R. J. Calificación de algunos aspectos de las prácticas de riego usadas en las siembras de trigo en El Bajío y su relación con la respuesta a fertilizantes. [**Evaluation of some aspects of irrigation practices used with wheat crops in El Bajío (Mexico) in relation to the response to fertilizers.**] *Fol. téc. 36 Sec. Agric. Ganad., México* 1959, pp. 48, bibl. 23, illus., English summary.

Investigations were carried out in 12 locations in El Bajío (1700 m alt., dry winters and wet summers) in the winter of 1956–7 to study the present irrigation practices, to determine the correct irrigation intervals and to observe the relationship between the response of wheat to fertilizers and irrigation practices. It was found that the irrigation interval should become progressively shorter from sowing until wheat begins to mature. The irrigation practices used were deficient primarily because they used the same interval instead of varying it in accordance with changes in evapotranspiration rates. The average number of irrigations considered to be optimal was the same as the average number applied. A table gives the recommended numbers of irrigations and the intervals in days between irrigations for 4 types of soil. During the first month of the wheat cycle, 75% of the water absorbed by the crop was taken from the 0–30 cm layer of soil. During the remainder of the cycle an average of 57% was taken from this layer. F. s.—E.B.O.

1576 Army, T. J. and others. **Precipitation-yield relationships in dryland wheat production on medium to fine textured soils of the Southern High Plains.** *Agron. J.* 1959, **51**, No. 12, 721–4, bibl. 5. [S.W. Great Plains Field Sta. Bushland, Texas]

Winter wheat yields from 3 commonly employed cropping sequences in the Southern High Plains were evaluated in relation to long-term weather records. In experiments conducted on Pullman silty clay loam, grain yields from continuous cropping, alternate wheat-fallow and in a wheat/sorghum/fallow rotation were significantly related to precipitation during the growing season (Oct.–June). Coefficients of determination showed that 55–66% of the variability in wheat yields was attributable to variability in precipitation during the growing season. Cumulative probability estimates of Oct.–June precipitation were used to establish yield level probabilities for each cropping sequence. With alternate wheat and fallow, or in a wheat/sorghum/fallow sequence, more than 10 bu grain/ac can be expected in 4 out of 5 seasons. Continuous cropping can be expected to produce more than 10 bu grain/ac in only 50% of seasons. Other calculated yield level probabilities similarly suggested that the use of a fallow system for dryland wheat production on the Southern High Plains would materially reduce the frequency of crop failures. Straw production, a major deterrent to wind erosion, was considerably greater with a fallow system than with continuous cropping. F. s.—A.M.H.

1577 Norfolk Agricultural Station. **Varietal trials with winter and spring cereals.** *Rep. Norfolk agric. Sta. 1958-9* Sprowston, 1959, 15–17.

Of new winter wheats tested in the very wet year of 1958, S.80, a Danish hybrid, outyielded

Hybrid 46 by a substantial margin. Of the 3 recommended varieties Hybrid 46, Cappelle Desprez and Minister, the last gave the highest yields and showed no sprouting in the ear. All 3 varieties and S.80 showed excellent straw stiffness. Winter oats were badly lodged, but S.147 gave the highest yields, followed by Powys and S.172. The best of the CA 148 series of winter oat hybrids from Cambridge gave high yields, as did a new hybrid from Aberystwyth, 5370/2/2/41, which is resistant to crown rust [*Puccinia coronata*], eelworm and mildew (*Erysiphe graminis*). In trials with spring wheat, the German variety E.L.S. (mildew-resistant) and the Belgian hybrid Jufy I were outstanding. Among spring oats, the Aberystwyth hybrid 4757/18/2/19 showed outstanding resistance to mildew.—P.J.B.

1578 Ciferri, R. and Bonvicini, M. Revisione delle vecchie razze italiane in rapporto ai frumenti mediterranei. 3. *Triticum durum* L. (Parte prima). [**A revision of the old Italian varieties in relation to the Mediterranean wheats. 3. *T. durum* L. (Part 1).**] *Suppl. Ann. Sper. agr.* 1960, **14**, No. 1, 53–119, illus.

Descriptions are given of 77 cultivars belonging to 11 botanical varieties of the tetraploid wheat *Triticum durum*, among which is the new var. *afronigrum*.—E.B.O.

1579 Ciferri, R. and Bonvicini, M. Revisione delle vecchie razze italiane in rapporto ai frumenti mediterranei. 3. *Triticum durum* L. (Parte seconda). [**A revision of the old Italian varieties in relation to the Mediterranean wheats. 3. *T. durum* (Part 2).**] *Suppl. Ann. Sper. agr.* 1960, **14**, No. 2, 63–128, illus.

Descriptions are given of 79 cultivars belonging to 7 botanical varieties of *Triticum durum*, among which are the new varieties *nigroafricanum* and *nigroapulicum*.—E.B.O.

1580 Farming in South Africa. **Wheat varieties tested at Vaalharts.** *Fmg in S. Afr.* 1960, **35**, No. 12, 22.

In trials with 241 varieties of wheat at the Vaalharts Research Station the varieties 75 W.C. 53, 112 W.C. 53, 160 W.C. 53 and 227 W.C. 53 yielded more than 30 bags/morgen [1 morgen = 2·117 ac] compared with 12–17 bags/morgen for the standard varieties Lalkasarwali, Korsorwalt, Punjab and Queen Fran.—S.M.J.

1581 Guerrero, S. D. Que se entiende por calidad de la semilla de trigo. [**What is meant by quality of wheat seed.**] *Agricultura téc., Méx.* 1959, No. 8, 15–16, illus. [Secr. Agric. Ganad., Mexico]

A list is given of 14 weed species infesting wheat crops in Mexico. Their seeds, which are present in wheat seed, are illustrated.—E.B.O.

1582 O'Keeffe, L. E. and others. **Effect of culm solidness on the survival of the wheat stem sawfly.** *J. econ. Ent.* 1960, **53**, No. 2, 244–6, bibl. 8. [N. Dakota Agric. Exp. Sta., Fargo]

The hard red spring-wheat varieties N.D. 51-3355, Mont. B50-18, Mont. B51-16, Canada 4352-96, Canada 4336-125 and Rescue grown at 4 locations were given 30 lb N plus 100 lb P_2O_5, or no fertilizer. Using survival of sawflies (*Cephus cinctus*) as a criterion for resistance, a relationship was demonstrated between stem solidness and sawfly resistance. Stem solidness was appraised by taking cross-sections just below the node and in the centre of the internode of one main stem and one tiller in each of 5 plants, recording stem solidness on a scale from 1–5 and averaging the readings. Fertilization had little effect on stem solidness. Small differences between wheat varieties in stem solidness were considered to have a strong influence on sawfly resistance.—R.B.

1583 Roberts, D. W. A. **Sawfly resistance in wheat. 3. Changes in resistance during the development of the wheat plant.** *Canad. J. Pl. Sci.* 1960, **40**, No. 1, 7–20, bibl. 11. [Canada Dep. Agric., Lethbridge, Alberta]

Data on attacks by the wheat stem sawfly (*Cephus cinctus*), obtained from field experiments with 7 wheat varieties, indicated that the resistance of wheat plants to infestation depended on the stage of development of the plants at the time of oviposition. Wheat plants were usually most heavily infested for part or all of the period from 1 week before the emergence of the flag leaf to 1 week after flowering. The resistance of Rescue, H46146, H4191, Golden Ball and Melanopus to development of eggs and first-instar larvae disappeared during the period between emergence of the flag leaf and flowering. This type of resistance did not occur in Thatcher and Red Bobs. Mortality of older larvae increased in plants which became infested towards maturity; the stage of development at which this increase occurred depended on the variety involved, and varied from just before the emergence of the flag leaf, as in H4191, to just after flowering, as in Golden Ball.—R.B.

1584 Holmes, N. D. and Peterson, L. K. **The influence of the host on oviposition by the wheat stem sawfly, *Cephus cinctus* Nort. (Hymenoptera : Cephidae).** *Canad. J. Pl. Sci.* 1960, **40**, No. 1, 29–46, bibl. 13. [Canada Dep. Agric., Lethbridge, Alberta]

Investigations on wheat stem sawfly infestations were carried out in 1953–8 with the spring bread wheats Red Bobs, Thatcher, Rescue and P.I. 17–0924 and with *Triticum durum* var. Golden Ball and Stewart. The first 2 varieties are considered susceptible and the others partially or

completely resistant. Results indicated that varietal differences in infestation were due mainly to differences in growth rate of the varieties and not to differences in varietal resistance to oviposition. Stems on which eggs were laid were over 20 mm long, and those between 50 and 400 mm long were preferred. The heaviest sawfly infestations occurred in those varieties which reached the optimum stage for oviposition at the same time as the peak of oviposition activity.—R.B.

1585 Wilson, M. C. and others. **The use of phorate to control aphids and the hessian fly on winter wheat.** *J. econ. Ent.* 1960, **53**, No. 2, 197–200, bibl. 7, illus. [Purdue Univ., Lafayette, Indiana]

Seed of Knox, Vermillion and Dual winter wheat was treated with phorate [=thimet] at 0, 0·25, 0·5, 0·75 or 1 lb per 100 lb seed prior to sowing in 1957 or 1958. Granulated phorate at 1·75 lb a.i./ac was broadcast on some of the plots during April. Seed treatment caused significant reductions in germination and crop stands, but not in grain yields. Phorate seed treatment at 0·5 lb/100 lb seed controlled *Phytophaga* [*Mayetiola*] *destructor*, *Rhopalosiphum fitchii* and *Macrosiphum granarium* [=*M. avenae*], while granulated phorate effectively controlled the spring generation of *P. destructor*. Where heavy insect infestations were present, treatment gave highly significant increases in grain yield. Mowing the wheat stands to simulate autumn grazing increased grain yields by 4–6 bu/ac on both treated and untreated plots. F. s.—R.B.

1586 Bardner, R. **Systemic insecticidal seed dressings.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 128–9.

In a comparison of formulations of γ-BHC and thimet, with or without different additives, used for treating seed of wheat and white mustard [*Sinapis alba*] polyvinyl acetate or methyl cellulose solution + activated carbon, used as additives, considerably lessened the phytotoxicity of γ-BHC seed-dressings to wheat ; polyethylene glycol and a solution of polyvinyl alcohol had similar but smaller effects. No aphids (*Rhopalosiphum padi*) on wheat were killed by any of the γ-BHC formulations tested. γ-BHC formulations were not phytotoxic when applied to mustard, but killed *Phaedon cochleariae* fed on the foliage. The use of activated carbon + methyl cellulose and polyvinyl acetate emulsions as additives retarded the uptake of γ-BHC. Thimet formulations which contained activated carbon + methyl cellulose solution or polyvinyl acetate were less toxic to wheat than standard formulations, while their aphicidal effect persisted longer at certain ratios of polyvinyl acetate or activated carbon to thimet. Like γ-BHC, thimet was not toxic to *S. alba* seedlings, but activated carbon or polyvinyl acetate prolonged the period of insecticidal activity against *P. cochleariae*. Activated carbon and polyvinyl acetate reduced the toxicity of sodium fluoracetate and pyrolan to wheat. When wheat and *S. alba* were treated with thimet and sown at distances of 0·5–1 in. from untreated seeds, the latter absorbed enough insecticide to become toxic to insects feeding on their foliage. Plants from untreated seeds absorbed more insecticide when grown near live, treated seeds than when grown near dead, treated seeds.—s.m.j.

1587 Martelli, G. and others. Contributo alla conoscenza del punteruolo delle spighe o baritichio del frumento (*Barytychius avulsus* Faust, Coleoptera : Curculionidae) e dei relativi mezzi di lotta. [**Contribution to the knowledge of the wheat weevil (*B. avulsus*) and of methods for controlling it.**] *Suppl. Ann. Sper. agr.* 1960, **14**, No. 2, 23–46, bibl. 6, illus., English summary. [Osserv. Malattie Piante, Bari, Italy]

An effective and economic method for controlling *Barytychius avulsus* on wheat was dusting the plants shortly before flowering with a preparation containing 1·5% γ-isomer [of BHC] at the rate of 40 kg/ha.—E.B.O.

1588 Jakubciner, M. M. **A contribution to the knowledge of the wheats of China.** [Russian] *Bot. Ž., SSSR* (*Bot. J., USSR*) 1959, **44**, No. 10, 1425–36, bibl. 26, illus., English summary.

1589 Hoshikawa, K. **Observations on the embryo sac containing double egg apparatus in *Triticum aestivum* L.** *Bot. Mag. Tokyo* 1960, **73**, No. 861, 107–12, bibl. 14, illus., Japanese summary. [Fac. Agric., Univ. Tokyo, Japan]

A morphological description is given of wheat embryo sacs containing a double egg-apparatus. The contribution of this phenomenon as a cause of polyembryony is discussed. The frequency of occurrence of a double egg-apparatus in 3 varieties of *T. aestivum* was 1 in 300.—D.B.

1590 Trentin, A. La purezza varietale dei frumenti destinati alla semina. [**Varietal purity of wheat seed (in Italy).**] *Sementi elette* 1960, **6**, No. 1, 20–5, English and German summaries. [Ist. Genet. Sper. Agr., N. Strampelli, Lonigo, Italy]

1591 McNeal, F. H. and others. **The evaluation of spring wheat seed from different sources.** *Agron. J.* 1960, **52**, No. 5, 303–4, bibl. 4 in text. [Crops Res. Div. USDA and Montana Agric. Exp. Sta., Bozeman]

Samples of Thatcher wheat seed grown from a common seed sample at 4 locations and contain-

ing 18·6, 17·3, 14·4 and 14·6% protein, with corresponding test weights of 55·7, 60·1, 55·8 and 60·6 lb/bu, respectively, were sown in 1958 at 4 locations in 12-in. rows at 10, 20, 30, 40, 50 or 60 seeds/ft of row. Highest yields were obtained with 30 seeds/sq. ft, i.e. 50–80 lb/ac. Differences in protein content and test weight of the seed used had no significant effect on crop yield, test weight or number of ears produced.—R.B.

1592 Kumar, K. and Tyagi, D. N. **Effect of electro-chemical treatment of seeds of wheat and tomato on growth, on yield and quality of grain or fruit.** *J. sci. Res. Banaras* 1959, **9**, No. 2, 115–22, bibl. 9. [Banaras Hindu Univ., India]

The method of electro-chemical treatment in 5% salt solutions (NaCl, $CaCl_2$, KNO_3) is described. Treatment in the chloride solution for 5 or 10 min increased the percentage germination of wheat grains, the N content of plants raised from treated seeds, the yields of grain and straw, and the auxin content of the grain. Treatment in KNO_3 solution was ineffective.—D.B.

1593 Chapin, J. S. and Smith, F. W. **Germination of wheat at various levels of soil moisture as affected by applications of ammonium nitrate and muriate of potash.** *Soil Sci.* 1960, **89**, No. 6, 322–7, bibl. 4. [Kansas Agric. Exp. Sta.]

Trials were carried out with Ponca wheat seed in a closed germination chamber in which a relative humidity of near 100% was maintained. The rates of fertilizers applied corresponded to 20, 40, 60, 80 and 100 lb/ac of either N or K_2O. Light silty clay loam soil of various moisture content was used as the germination medium. Results showed that : (a) variation in the percentage of soil moisture from just below the permanent wilting point to field capacity, caused but slight variation in germination when fertilizer was not used ; (b) fertilizers placed with seed at sowing in soil that was at or near field capacity had little effect on final germination, but caused some delay in seedling emergence ; (c) if fertilizers were placed in direct contact with the seed and if the soil moisture was at or near the permanent wilting point germination was reduced greatly or even prevented by heavy applications of fertilizers ; (d) a given amount of N delayed germination more, and caused greater final losses in germination, than did the same amount of K_2O. F. s.—E.B.O.

1594 Tsui Cheng, W. B. K. **The effect of microelements on the respiration and nitrogen compounds during vernalization of wheat.** *Acta bot. sinica* 1959, **8**, No. 4, 239–42, bibl. 19. [Nankai Univ., China]

1595 Weibel, R. O. **Effect of gibberellin on the vernalization period of winter wheat.** *Agron. J.* 1960, **52**, No. 2, 122–3, bibl. 1 in text, illus. [Illinois Agric. Exp. Sta., Urbana]

Vermillion soft red winter wheat was germinated in a laboratory, sprayed with 0·005% K gibberellate aerosol for 1 or 2 seconds when the shoots were 0·25 in. long, kept at 1°C for 1–8 weeks, and treated with GA every 1, 2 or 3 weeks during that period. The seedlings were transferred to a glasshouse and grown under 14 hr day-length. Normal flowering occurred in plants not receiving GA and kept at 1°C for 7 or 8 weeks, and in plants treated with GA and kept at 1°C for 4 or more weeks.—R.B.

1596 Fustec-Mathon, Éliane and Mathon, C.-C. Lumière et développement. (Influence des radiations de grande longueur d'onde sur la formation des épis chez les Graminées). (Seconde note). [**Light and development. Influence of long-wave radiations on ear formation in the Gramineae. (Second note).**] *Bull. Soc. bot. Fr.* 1958, **105**, No. 7–8, 323–32, bibl. 44. [Seen June, 1960]

[For Note 1 see *Fld Crop Abstr.* 12 : 1119.] Under a photoperiod of 16 hr (artificial light) the addition of radiations in the far red and infra-red bands to radiations in the visible part of the spectrum caused an acceleration in the morphogenesis of the ear primordia in plants of wheat and barley, both of which are long-day plants.—E.B.O.

1597 Coïc, Y. Sur l'utilisation de l'azote par le blé lorsque l'eau ou la lumière sont en quantité insuffisante : relations avec l'utilisation de l'eau. [**N utilization by wheat when the quantity of water or light is insufficient : relationships with the utilization of water.**] *Ann. Physiol. vég., Paris* 1959, **1**, No. 4, 265–72, bibl. 3. [Sta. Cent. Physiol. Vég., Versailles, France]

The main results from pot trials, which began when the wheat plants were in the flowering stage, were : (a) when water was sufficient, a late application of N increased grain yields considerably both under normal light and in shade ; (b) when water was deficient, a late application of N had no significant effect on grain yields, and, conversely, without a late application of N, grain yields were not increased by supplying water *ad lib* ; (c) in shade and with sufficient water, a late application of N increased the consumption of water.—E.B.O.

1598 Seth, J. and others. **Nitrogen utilization in high and low protein wheat varieties.** *Agron. J.* 1960, **52**, No. 4, 207–9, bibl. 4. [N. Carolina Agric. Exp. Sta., Raleigh]

N utilization was studied in 4 wheat varieties, 2 of which, Atlas 66 and Y2223-37, had a high grain protein content, and 2, Leap and Chan-

cellor, had a low grain protein content. In the field, no differences in percentage protein among the 4 varieties were apparent until after earing. At the milk stage and at maturity the roots of Atlas 66 and Y2223-37 contained less protein than those of the other 2 varieties. The relative grain protein content of the 4 varieties was similar in plants grown in field plots, glasshouse trials and nutrient culture. Differences in grain protein content among varieties appeared to be associated with differences in the rate of protein formation in the developing grain. F. S.—R.B.

1599 Dorofeev, V. F. **The structural characteristics of the upper adventitious roots of wheat.** [Russian] *Bot. Ž., SSSR* (*Bot. J., USSR*) 1960, **45,** No. 2, 276–9, bibl. 15, illus.

This study was made with *Triticum durum, T. aestivum* and *T. compactum.* The significance of the mechanical function of the roots in relation to the resistance of the plants to lodging is mentioned.—M.H.

1600 Virgin, H. I. **Pigment transformations in leaves of wheat after irradiation.** *Physiol Plant.* 1960, **13,** No. 1, 155–64, bibl. 17, [Inst. Pl. Physiol., R. Agric. Coll., Uppsala]

1601 Allan, R. E. and others. **Comparative response to gibberellic acid of dwarf, semidwarf and standard short and tall winter wheat varieties.** *Agron. J.* 1959, **51,** No. 12, 737–40, bibl. 10. [Washington Agric. Exp. Sta., Pullman]

The growth responses of 6 wheat varieties injected at 6-weekly intervals with concentrations of GA ranging from 0 to 1000 ppm were studied under glasshouse conditions. The varieties were : (a) dwarf, Tom Thumb ; (b) semidwarf, Seu Seun 27, Norin 10 × Brevor 2238 and Norin 10 × Brevor 14 ; (c) standard height, Burt and Kharkof MC 22. The effect of the treatments on plant height, size of internode and spike emergence of the 6 varieties was determined and compared. The dwarf and semidwarf varieties were not induced to grow to normal height by treatment with GA. Standard-height varieties were stimulated significantly more than short varieties. Spike emergence of the 3 tallest varieties was hastened sigficantly. In most cases, maximum stimulation occurred after the 100-ppm GA treatments. The 1000-ppm concentration sometimes inhibited growth. F. S.—A.M.H.

1602 Rufelt, H. **Changes in the transpiration of wheat leaves caused by changes in the properties of the root medium.** *Physiol. Plant.* 1959, **12,** No. 2, 390–9, bibl. 22. [Inst. Physiol. Bot., Univ. Uppsala]

Increasing the concentration of nutrients from $10^{-3}M$ to $10^{-2}M$, adding solutions of single salts, and decreasing the temperature all resulted in increased transpiration of wheat leaves within 30 sec after the treatments began. The addition of 2,4-dinitrophenol ($5 \times 10^{-5}M$) increased the O_2 consumption of the roots within 10–20 min of treatment and the addition of alcohol, monoiodoacetic acid and heavy metals resulted in an initial increase in transpiration, followed by a decrease.—S.M.J.

1603 Holmes, N. D. and others. **Influence of periodic shading on the length and solidness of the internodes of Rescue wheat.** *Canad. J. Pl. Sci.* 1960, **40,** No. 1, 183–7, bibl. 7. [Canada Agric. Res. Sta., Lethbridge, Alberta]

Rescue wheat was sown on 16 May 1956 and shaded [relative light intensities not given] during the following periods : (a) emergence to 2-leaf stage, (b) 2-leaf to 4-leaf stage, (c) 4-leaf to boot stage, (d) seedling emergence to boot stage, (e) boot stage to earing. Treatment (b) decreased the length of the lowest 4 internodes, treatment (c) increased the length of the first 3 internodes and decreased that of the 4th and 5th internode, treatment (d) increased the length of the second internode and decreased that of internodes 3, 4 and 5, while treatment (e) increased the length of internode 4 and decreased that of internode 5. Shading during the initiation of elongation of an internode reduced its final length, while shading during a later stage of elongation caused the internode to elongate as much as or more than if the plant had remained unshaded. The solidness of the lowest internode was reduced most by (b) and (c), that of internodes 2 and 3 by (c), and that of internode 4 by (e). All shading treatments tended to cause the lower 3 internodes to become hollow. Treatment (e) alone caused severe lodging.—R.B.

1604 Heber, U. Ursachen der Frostresistenz bei Winterweizen. 2. Die Bedeutung von Aminosäuren und Peptiden für die Frostresistenz. [**Causes of frost resistance in winter wheat. 2. The importance of amino acids and peptides in frost resistance.**] *Planta* 1958, **52,** No. 4, 431–46, bibl. [Inst. Landw. Bot., Univ. Bonn, W. Germany]

This is a further contribution towards probing the physiological mechanism of frost resistance. (See also *Fld Crop Abstr.* 12 : 360 and 1677.) During the course of frost-hardening experiments on winter wheat it was observed that although the increase in sugar content of a plant was accompanied by an accumulation of amino acids, these latter did not prevent degradation (as a result of frost) of the plasma proteins. Additive compounds with sugars did not give frost hardiness. Although animal peptides protect plasma from frost damage it was not demonstrated that the peptides of wheat could do so. After severe frost there was a sharp increase

in the asparagin and protein content of wheat which was a consequence of controlled degradation of frost-damaged plasma proteins in cells which had not been killed by frost [See also next Abstract]. —D.B.

1605 Heber, U. Ursachen der Frostresistenz bei Winterweizen. 3. Die Bedeutung von Proteinen für die Frostresistenz. [**Causes of frost resistance in winter wheat. 3. The importance of proteins for frost resistance.**] *Planta* 1959, **54**, No. 1, 34–67, bibl. [Inst. Landw. Bot., Univ. Bonn, W. Germany]

Only a limited proportion of plasma proteins (including all the green ones) coagulated at low temperatures. The frost resistance of different varieties of wheat was inversely proportional to the quantities of frost-sensitive proteins. The soluble proteins were insensitive to frost but the protection they provide for the plant is greatly inferior to that provided by sugars. The assimilatory processes of a plant are much more sensitive to frost than are the respiratory processes.—D.B.

1606 Andrews, J. E. **Cold hardiness of sprouting wheat as affected by duration of hardening and hardening temperature.** *Canad. J. Pl. Sci.* 1960, **40**, No. 1, 94–103, bibl. 9, illus. [Canada Agric. Res. Sta., Lethbridge, Alberta]

Winter wheat, var. Kharkov 22 M.C., Minturki, Nebred, Jones Fife and Elgin, were germinated for 16 hr at 22°C and transferred to 1·5°C in darkness for 2–11 weeks. Frost hardiness of seedlings, as measured by survival after 16 hr at −15°C, increased rapidly during the first 5 weeks of hardening and decreased rapidly after the 7th week. Kharkov 22 M.C. and Minturki, hardened for up to 5 weeks in darkness at 3·5°C, reached maximum frost hardiness within 4 weeks, but were less resistant to frost than plants hardened at 1·5°C ; supplying 8 or 24 hr light/day caused a slight increase in frost hardiness, reaching a maximum after 4 weeks. Plants hardened at 5°C failed to survive the low temperature treatment. —R.B.

1607 Pauli, A. W. **Relation of crown tissue to winter survival in hard red winter wheat.** *Agron. J.* 1960, **52**, No. 5, 265–6, bibl. 7. [Kansas Agric. Exp. Sta., Manhattan]

Pawnee winter wheat grown in pots in the open until mid-Dec. was frozen from 1 to 5 times, each exposure consisting of a 24-hr period at 4°F. Changes in the condition of crown tissue as a result of freezing were compared with percentage survival and rate of recovery of surviving plants. Decreases in percentage survival and rates of recovery following successive exposures to low temperature were attributed to decreases in the amount of functional vascular tissue connecting tops and roots when crown tissue was killed. Early death of axillary buds and of plants apparently surviving exposure to low temperatures occurred when water and nutrients above the dead crown tissue had been exhausted. Biochemical research on crown tissue in relation to cold hardiness was considered necessary. F. S.—R.B.

1608 Sandhu, A. S. **Association between heat hardiness and winter hardiness in wheat.** *Indian J. Agron.* 1959, **4**, No. 2, 101–4, bibl. 8. [Kansas State Coll. Agric., Manhattan, USA]

Wheat plants which had been (a) winterhardened and (b) winterhardened and subsequently dehardened were submitted to temperatures of 125–127°F for 13 hr in the laboratory, the relative air humidity being 30–40% ; the soil remained moist. Heat-hardiness was assessed by the number of surviving tillers. Winterhardening induced heat-hardening, and dehardening (to cold) resulted in reduced heat-hardiness. A study of varieties from Belgium, Turkey, Portugal and China leads to the view that there is a close association (probably in the nature of the protoplasm) between heat-hardiness and winterhardiness.—D.B.

1609 Woofter, H. D. **The retention and effect of 2,4-dichlorophenoxyacetic acid (2,4-D) sprays on winter wheat.** *Diss. Abstr.* 1959, **20**, No. 6, 1949–51. [Ohio State Univ., Columbus]

Rates of 0·75, 1, 1·5 and 3 lb a.e. 2,4-D/ac all significantly reduced wheat yields when applied at susceptible stages. There were no significant differences between the effects on yields of spray volumes of 3, 6 and 12 gal/ac. Wheat varieties differed significantly in their response to 2,4-D, but not all varieties showed the same relative degree of susceptibility at different growth stages. Varietal differences in response could not be attributed to differences in spray retention. The germination of the grain from plants treated at the early head stage was reduced slightly and plants suffered most yield reduction when treated at this stage. Plants were most resistant to 2,4-D applied between the fully-tillered and the jointing stages. Effective wetting agents added to triethanolamine formulations of 2,4-D made them more phytotoxic to wheat than ester formulations applied without wetting agents.—P.J.B.

1610 Serry, A. and Eid, M. T. **The effect of the hydrogen ion concentration and mineral deficiency on the growth and chemical composition of Egyptian clover and wheat.** *Bull. 289 Min. Agric., Egypt* Cairo 1959, pp. 14, bibl. 10.

The effect of mineral deficiencies on the uptake of P and Mg by wheat was investigated using sand cultures. When Mg was deficient, P uptake was reduced at pH 7. In the absence of P, Mg uptake decreased by about 36%.—S.M.J.

1611 Aufhammer, G. Klebermenge und Klebergute des Weizens in ihren Beziehungen zur Qualität und Ertrag unter dem Einfluss der Umwelt. [**Quantity and quality of gluten of wheat in relation to quality and yield under environmental conditions.**] *Bayer. landw. Jahrb.* 1959, **36,** No. 6, 651–78, bibl. 13. [Landessaatzuchtanstalt Weihenstephan, Bavaria, W. Germany]

The effect of climatic factors on the quantity and quality of gluten was tested during 1935–49. The quantity of gluten increased markedly with increased rainfall, shorter periods of sunshine and lower temperature during the main period of growth. Varieties which produce high grain yields per unit area tend to have a low moist-gluten content, and *vice versa.* Gluten quality, which determines baking quality, was influenced to a much less extent by environment. It was genetically determined and varieties exhibited great differences in this respect.—D.B.

1612 El-Gindy, M. M. S. A. **The distribution of minerals and proteins in whole wheat, flour and flour fractions as influenced by variety, season and fertilizer applications.** *Diss. Abstr.* 1959, **20,** No. 6, 1941–4, bibl. 4. [Ohio State Univ., Columbus]

The experiments reported were carried out with the varieties Cornell 595, Seneca and Pawnee, grown on Wooster silt loam and receiving different combinations of N, P and K.—P.J.B.

1613 Tombesi, L. and others. Indagini di diagnostica fogliare su frumento nel corso di prove di concimazione in terreni vulcanici analcitici del Lazio. [**Investigations on foliar diagnosis of wheat during manuring trials on analcitic volcanic soils in Latium (Italy).**] *Ann. Sper. agr.* 1960, **14,** No. 1, 5–16, bibl 3, illus., English summary. [Sta. Chim.-Agr. Sper., Roma]

In certain soils of the Latium recently put under cultivation, which have a low content of exchangeable K, wheat crops had thin stands and gave low grain yields. In manurial trials on these soils with the wheat variety Funo, foliar diagnosis carried out during the vegetative cycle was valuable for indicating the effect of different availabilities of K in the soil. The highest grain yields (3930 kg/ha, against 1470 kg from the controls) were obtained with the application of 240 kg P_2O_5, 300 kg K_2O and 120 kg N, per ha. The yields obtained from applying 90 kg N/ha were not significantly lower than from applying 120 kg. The amounts of P and K applied could be reduced in subsequent years.—E.B.O.

1614 Neenan, M. **The effects of soil acidity on the growth of cereals with particular reference to the differential reaction of varieties thereto.** *Plant and Soil* 1960, **12,** No. 4, 324–38, bibl. 19, illus. [Johnstown Castle Agric. Coll., Wexford, Ireland]

The wheat varieties Atle, Karn, April Red and Progress, which under field conditions showed a differential response to liming, were grown in 9-in. pots containing loam soil (pH 5) on which crops had responded markedly to liming, and were given 0, 1·25, 2·5, 10·0, 12·5, 17·5 or 20 g CaO/pot. At low levels of liming, Progress and April Red showed most vigour and Atle least. April Red showed least response to liming treatment. Grain produced at low levels of liming was shrivelled and contained little endosperm. April Red and Atle showed no significant increase in total dry-matter yield above pH 5·5 and 5·8, respectively. Karn showed a marked response to liming between pH 5·6 and 6·6, while Progress yielded most at pH 6·6. Yield was negatively correlated with Al content in Atle, Progress and Karn, with Mn content in Atle, with Ca content in Karn, and with soil pH in all varieties except Progress. Differences in response to liming were considered to be caused by differential responses to Mn, Al, Ca, and possibly to deficiency of Mo. In sand-nutrient culture where Al at 0, 36 or 54 ppm and Mn at 0, 55 or 82 ppm were applied twice weekly, alternating with nutrient solution, Atle developed symptoms of toxicity at the higher levels of both ions, and Progress at both levels of Al, while Karn and April Red showed less marked symptoms of Al toxicity than did the other 2 wheat varieties. Al at the higher level significantly decreased grain yield in Progress, and Mn reduced that of Spratt-Archer barley to an almost significant extent. Of 4 oat varieties grown in this trial, yields of Star were significantly increased by the lower level of Mn. In a second nutrient experiment, the 4 wheat varieties previously used were grown with culture solutions containing 0, 108, 162, 216 or 270 ppm Al, and 0, 27, 55, 82, 110 or 137 ppm Mn. Al affected Progress most and April Red least. Atle and Karn were severely affected by Mn, Progress was only slightly affected, and April Red hardly at all. The wheat varieties tolerated higher levels of Mn than in the soil experiment, possibly because of Mo deficiency in the latter.—R.B.

1615 Pinevič, V. V. [**The effect of supplementary nutrition with different forms of N fertilizers on the quality of wheat grain.**] [Russian] *Vestn. Leningrad Univ., Ser. Biol.* 1960, **15,** No. 3, Pt. 1, 56–66, bibl. 52, English summary.

An experiment made during 1948–54 with the wheat variety Diamant is reported. It was designed to determine the effect of different forms of N fertilizers (nitrates, ammonium sulphate and urea,

applied at various growth stages) on grain quality. The data show that the application of N fertilizers during the earing/ripening stage increases the total grain weight and the percentage of protein in the grain. Application of the reduced forms of N at a late growth stage decreases the content of gliadin in the grain and increases the glutenin content. Nitrates have the opposite effect. Changes in the proportion of the separate P compounds are determined by the oxidation-reduction processes in the plant which, in turn, are affected by the different N fertilizers in the soil.—M.H.

1616 Bovay, E. Versuche mit Harnstoffblattdüngung auf Winterweizen. [**Leaf-manuring of winter wheat with urea.**] *Schweiz. landw. MH.* 1960, **38**, No. 6, 275–80. [Stations Fédérales d'Essais Agricoles, Lausanne]

In trials carried out in an area between the Jura and the Lake of Geneva, leaf manuring of winter wheat during its growth period resulted in considerably higher yields of grain and straw. These experiments were conducted during dry summers. F. Ger. s.—D.B.

1617 Masson, P. and Bazier, R. La récolte de blé en 1958 et 1959 dans les parcelles du champ d'expériences de la Station agronomique de Grignon. [**Wheat yields in 1958 and 1959 on plots of the experimental field of the Agronomic Station of Grignon.**] *C.R. Acad. Agric. Fr.* 1960, **46**, No. 6, 296–303, bibl. 2. [Éc. Nat. Agric. Grignon, France]

Tables show wheat yields (grain and straw) in 1958 and 1959 (2 years with very different climatic conditions) from plots subjected to different manurial treatments for many years.—E.B.O.

1618 Leu, H. Mehrjährige Stickstoffdüngungsversuche an Winterweizen. [**Long-term nitrogen manuring trials with winter wheat.**] *Schweiz. landw. MH* 1960, **38**, No. 2, 53–65, illus. [Landw. VersAbteil. der Lonza A.G., Basel]

1619 Beni, G. Interazione stazione x varietà e prove pluriannuali nella sperimentazione collegiale sul frumento per l'Italia settentrionale. [**Interaction between locality and variety, and trials over several years, in testing wheats for northern Italy.**] *Genet. agr.* 1960, **11**, No. 3–4, 377-93, bibl. 4, English summary. [Ist. Genet. e Sper. Agr. N. Strampelli, Lonigo, Italy]

It is concluded that trials over several years can be replaced by 1-year trials in several localities when testing new varieties of wheat.—E.B.O.

1620 Neururer, H. Die Lagerfähigkeit von schlämm- und trockengebeiztem Saatgut. [**The storage of seed treated by the dry and the slurry method.**] *PflSchBer.* 1960, **24**, No.1/2, 1–13, bibl. 9, English summary. [Bundesanst. Pflanzenschutz, Wien, Austria]

Wheat seed having a 14% moisture content, after treatment with Hg-containing compounds by the dry and by the slurry method, can be stored for 1 year without impairing germinating capacity or germinating energy. At low temperatures, such as obtained in the field, a mercury-containing lindane product caused a reduction in germinating capacity and germinating energy after 6 months' storage.—D.B.

1621† **Switzerland.** Eidg. Landwirtschaftliche Versuchsanstalt, Zürich-Oerlikon. **Trials in the storage of winter wheat.** *Landw. Jahrb. Schweiz* 1959, 73, No. 7, 703–4, illus., bibl. 1.

Since moist seed loses viability more quickly than dry seed, and since the moisture content of seed in the lower central part of a sack of seed is often 2–4% higher than in seed near the surface of the sack, it is recommended that seed should be sampled with a long probe, having equally spaced sampling points, inserted diagonally throughout the sack.—D.B.

BUCKWHEAT

1622 Shishido, H. and others. **On the foliar application of the nutrient to the buckwheat cultivated in the soil of the sand dune. (3). On the relationship between the soil moisture, the nitrogenous substance and the carbohydrate of the buck wheat grain.** [Japanese] *Bull. Yamagata Univ. (Agric. Sci.)* 1959, **3**, No. 1, 289-306, bibl. 27, English summary.

1623 Sugawara, K. **On the sterility of buckwheat. With special reference to the accumulation of starch in stem.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1960, **28**, No. 3, 313–15, bibl. 3, English summary. [Iwate Univ.]

OATS

See also Abs. 1577, 1614.

1624 Davies, T. G. **A spring oat variety resistant to the stem eelworm.** *Nature, Lond.* 1960, **186**, No. 4727, 813, bibl. 3. [NAAS, Bangor]

In Denbighshire during 1959 an oat variety trial was sown in a field which later was found to be infested with the oat race of stem eelworm (*Ditylenchus dipsaci*). Of the 6 oat varieties sown, a high degree of resistance was shown only by 4757/18/2/19, bred by the Welsh Plant Breeding Station ; it is to be introduced commercially and named Manod (S 235).—M.H.

1625 Inkila, O. Kauran lajikekokeista jokioisissa. [**Results of oat varietal trials at Jokioinen.**] *Maatal. ja Koetoim.* 1960, **14**, 33–44, illus. [Agric. Res. Sta., Jokioinen, Finland]

Trials of 23 oat varieties were made between 1944 and 1959 at Jokioinen, altitude 95 m. Tabulated information on the results is presented. The standard for comparison was the Svalöf variety Guldregn II (Golden Rain II), formerly generally grown in the south of Finland. F. Ger. s.—G.M.R.

1626 Baker, G. **Hook-shaped opal phytoliths in the epidermal cells of oats.** *Aust. J. Bot.* 1960, **8**, No. 1, 69–74, bibl. 5.

The oat plant is an important opal-accumulator in Victoria. The precipitation of amorphous silica as opal phytoliths in the epidermal cells is described.—S.M.J.

1627 Frey, K. J. and others. **Lodging resistance studies in oats. 3. Optimum number of plots and samples for cL_r and snap scores.** *Agron. J.* 1960, **52**, No. 5, 289–91, bibl. 4. [Iowa Agric. Exp. Sta., Ames, and Idaho Agric. Exp. Sta., Moscow]

Lodging resistance studies were carried out in 1956, using Bonham, Clinton and Marion oats, by means of the snap and the cL_r methods [see *Fld Crop Abstr.* 8 : 406 and 12 : 1143]. In tests at 2 locations the coefficients of variation for the cL_r method were 36 and 47%, while at 1 location that for the snap test was only 12%. Costs per plot were equal for the 2 methods, but cost per sample using the cL_r method was double that for the snap method. Where oat rows were over 2 ft long, the snap method was preferable to the cL_r method.—R.B.

1628 Ogata, C. and Caldwell, A. C. **Nitrate content of soils and nitrogen content of oat plants as affected by rates of liming.** *Agron. J.* 1960, **52**, No. 2, 65–8, bibl. 6. [Minnesota Agric. Exp. Sta., St. Paul]

Silt loam soil was dressed in autumn 1948 with dolomitic limestone at 2, 4, 8 or 16 tons/ac and cropped with oats each year, or left fallow in 1949 and '50 and sown with oats in 1951. In 1951, the average N content of oat plants grown after fallow was 2·3% when sampled on 14 July, compared with 1·3% for oats following oats. The N content of oats grown in 1949 was increased by liming, but increasing the rate of liming did not cause a progressive increase in N content.—R.B.

1629 Frey, K. J. **Yield components in oats. 3. Their contribution to the variety × location interaction for grain yield.** *Agron. J.* 1959, **51**, No. 12, 744–6. [Iowa Agric. Exp. Sta., Ames]

An example was constructed to show that a strain × environment interaction for yield may exist even though the strain × environment interaction is zero for the 3 yield components, number of heads per plant, number of seeds per head and weight per seed. The multiplicative type of interaction among the components to produce yield can thus be a factor in causing a variety × location interaction variance. In experiments to test this hypothesis, in all cases but one, yield components had a lower variety × location interaction variance than did grain yield. In 1957, the correlations between grain yield measurements in separate experiments were all non-significant, whereas for yield components all but one were highly significant, indicating that yield components were more predictable from one location to another than was grain yield. F. s.—A.M.H.

RYE

1630 Pohjakallio, O. and others. **On the effect of vernalization on some characters of two winter rye varieties.** *Suom. Maataloust. Seur. Julk.* 1959, **94**, No. 4, 65–72, bibl. 7, illus.

The varieties studied were the Finnish Ensi and a tetraploid rye of Swedish origin which has been cultivated in S. Finland for some years. The thermophase was completed in a shorter period of chilling in Ensi than in the tetraploid variety, although Ensi appeared to be the more winter-hardy of the two. This difference manifested itself in experiments in which no low-temperature fungi were to be seen, as well as in those where snow mould had infected the plants. In plants grown from seed chilled for a relatively short period only, the number of ears was the greatest, whereas a long chilling period favoured a high grain/total yield ratio. F. s.—G.M.R.

BARLEY

See also Abs. 1574, 1596, 1614.

1631 Norfolk Agricultural Station. **The use of nitrogen for barley in relation to variety.** *Rep. Norfolk. agric. Sta. 1958-9* Sprowston, 1959, 7–9.

In 3 years' tests with Proctor, Provost and Maythorpe barley sown at seed rates of 1·5, 2·25 and 3 bu/ac together with 0, 1·5 and 3 cwt 15% N fertilizer/ac, Proctor was superior in yield and quality.—J.D.J.

1632 Gill, W. D. and others. **Spring barley variety trials, 1956-8** *Scot. Agric.* 1960, **39**, No. 4, 208–13.

Nine spring barley varieties were grown in

15 trials in Scotland from 1956–8 and compared with Ymer. All yields were expressed as a percentage of those of Ymer (33·7 cwt/ac mean yield on an 18% moisture content basis). Bonus 1, Bonus 2, Vada and Mentor yielded 5, 2, 5 and 7 % more than Ymer, respectively. Vada had stiffer straw than Ymer and was resistant to mildew [*Erysiphe graminis*], but the grain was of lower malting quality. Mentor was short-strawed, matured earlier than Ymer and was suitable for malting ; it was mildew-resistant, but susceptible to loose smut [*Ustilago tritici*].—S.M.J.

1633 Cussen, G. **Report of Cereal Station, Ballinacurra, 1956.** *J. Dep. Agric. Republ. Ire.* 1957–8, **54**, 230–41. [Received Jan., 1960]

In a small-scale barley variety trial with 25 varieties, S.A.K. 137 and Freja × Spratt Archer 37 No. 3/51 gave the highest yields (both 22·3 cwt/ac). Beorna had the highest 1000-grain weight (40 g). Grain quality was poor and no malting tests were made. In a drill-strip trial with 6 varieties, S.A.K. 131 and Provost showed good resistance to lodging and ripened later than Beorna ; there were no significant yield differences. In a further trial S.A.K. 17/148 and Ingrid were the earliest to ripen and Freja × Spratt Archer 9 the latest. The latter cross showed the highest lodging resistance and S.A.K. 54 the lowest. There were again no significant yield differences. In the European Brewery Convention trial, Proctor yielded significantly more than Beorna, Domen, Kenia and Busser. Domen had the highest 1000-grain weight (39·4 g) and Beorna the lowest content of N in the grain (1·47%). The results of large-scale barley variety trials carried out at 12 centres, and including Beorna, Proctor, S.A.K. 17/8, S.A.K. 17/2 and S.A.K. 22/8, are tabulated.—A.M.H.

1634 Bjaanes, M. Forsøk med byggsorter. **Trials with barley varieties.** *Forskn. Fors. Landbr.* 1960, **11**, No. 1, 97–147, English summary.

The results are given of barley varietal trials at 8 centres in Norway from 1953–7. Varieties suitable for different areas of Norway were selected. Weibull's Ingrid gave the highest yield and was equal to Herta in straw stiffness. Domen was equal to Herta in E. Norway, but was inferior in S.W. Norway. Domen had stiff straw and high malting quality. Maskin, Jotun and Åsa were recommended for areas at altitudes above 700 m. —S.M.J.

1635 Société d'Encouragement de la Culture des Orges de Brasserie et des Houblons en France. Rapports sur la campagne 1958. [**Report for the season 1958.**] [n.d.], pp. 67. [Received Apr., 1960]

An account is given of trials with varieties of malting barley in various regions of France. The weather during the season was generally unfavourable, mainly because of long rainy periods in May, June and early July. As a consequence the grain was generally discoloured. Of 77 samples of grain examined, 16 had a germination lower than 95% ; the average extract was 79·84% and the average protein content 9·75%. Of the varieties mostly grown, Beka (28 samples) had the highest extract (80·97%) and had a protein content of 9·68%. Aurore (35 samples) had 79·01% extract and a protein content of 9·56%.—E.B.O.

1636 Grillot, G. La classification des orges cultivées (*Hordeum sativum* Jessen) et nouvelles variétés d'orge. [**The classification of cultivated barleys (*H. sativum*) and new barley varieties.**] *Ann. Amélior. Pl., Paris* 1959, **9**, No. 4, 445–552, bibl. 68, illus., English, German and Russian summaries. [Centre Rech. Agron., Rabat, Morocco]

The object of this study was to find a practical way of co-ordinating previous botanical systems of classification of cultivated barleys based on the principal characters of the ear and spikelets. The new system of classification proposed allows new varieties to be included, many of which have been bred at Rabat. A list is given of sub-species, varieties and sub-varieties of *Hordeum sativum*.—E.B.O.

1637 Krzysch, G. and Eberhardt, W. Die Bekämpfung des Getreide-Mehltaues (*Erysiphe graminis* D.C.) durch ernährende Blattspritzungen. [**Control of cereal mildew with leaf manuring.**] *Z. PflErnähr. Düng.* 1960, **88**, No. 3, 193–202, bibl. 10. [Techn. Univ. Berlin-Charlottenburg, Germany]

As shown by pot experiments, spring barley was protected from attack by *Erysiphe graminis* by spraying the leaves with weak solutions (2–2·6%) of one of the following nutrients : superphosphate, complete fertilizer Hoechst, ' potash ammonium nitrate ' or ' nitrogen-magnesia '. These protective treatments also resulted in higher yields of grain, straw and crude protein and in a higher P_2O_5 and K_2O content of the grain. Similar results were obtained from field experiments with spring barley and winter wheat. Urea had no prophylactic action.—D.B.

1638 Bullock, J. A. [**The control of barley fly. *Hylemyia arambourgi.***] *Rep. Dep. Agric. Kenya 1958* 1960, 12–13.

In investigations on the control of *Hylemyia arambourgi*, applications of dieldrin at 5 oz a.i./100 lb seed gave the best control and 2 oz dieldrin a.i./100 lb seed gave some degree of control.—S.M.J.

1639 French, R. C. **Formation of embryo starch during germination as an indicator of viability in heat-damaged barley.** *Pl. Physiol.* 1959, **34**, No. 5, 500–5, bibl. 11. [Agric. Mktg Serv. USDA, Beltsville, Maryland]

The optimum temperature for starch formation in excised embryos of Oderbrucker barley floated on distilled water was 25°C. Embryos excised from barley previously heated to 70, 80, 85 or 100°C [moisture content during heating not given] for up to 96 hr were floated on distilled water for 8 hr at 25°C. The percentage of embryos which stained blue when treated with iodine was closely correlated with the percentage germination of similarly-treated seed. Heat treatment at 85°C for 48 hr or less had little effect on percentage germination, while a marked decrease occurred in seed heated for 96 hr. The amount of amylose formed in the embryo after 8 hr, as measured by colorimetry, was proportional to the height, total fresh weight and increase in fresh weight of seedlings 5 days old.—R.B.

1640 Bergqvist, Gerd and others. **The influence of gibberellic acid on the transaminase content of germinating barley seeds.** *Physiol. Plant.* 1959, **12**, No. 1, 386–9, bibl. 9. [Res. Dep., AB Kabi, Stockholm]

When freshly harvested barley grain was soaked in solutions containing 1 – 30 ppm gibberellic acid and then allowed to germinate, its glutamic-oxalacetic-transaminase content was twice that of similar grain soaked in water. The response to gibberellic acid decreased 4–5 months after harvest and the glutamic-pyruvic-transaminase content increased. F. s.—s.m.j.

1641 Dantuma, G. and Andrews, J. E. **Differential response of certain barley and wheat varieties to hardening and freezing during sprouting.** *Canad. J. Bot.* 1960, **38**, No. 2, 133–51, bibl. 14, illus. [Agric. Res. Sta., Lethbridge, Alberta]

Seed of 9 varieties of winter barley, 1 of spring barley, 14 of winter wheat and 2 of spring wheat, originating from different geographical areas, was germinated at 22°C for 16 hr. The seedlings were then hardened at 1·5°C for 1–5 weeks (barley) or 2–10 weeks (wheat), before being exposed to −9°C or −14°C for 8 hr and 1·5°C for 16 hr, and then grown at 15°C. Some barley samples were hardened for 1 week at 1·5°C and at −4°C for an additional 2–4 weeks before being exposed to the lowest temperatures. Some wheat samples were hardened at 5°C for 1 week and 1·5°C for 1–9 weeks, or at 1·5°C for 1–5 weeks and for the same length of time at −4°C. Nearly all the varieties exhibited a relatively high degree of cold-hardiness and ability to harden for a period of up to 1 week at 1·5°C, and minimum hardiness after 2–3 weeks' hardening at that temperature. After 6 weeks' hardening, a second maximum of hardiness occurred, except in spring varieties and in Cappelle wheat. The barley varieties Atlas, Meimi and C.I. 7407/3 were fully vernalized after 4–5 weeks at 1·5°C. Additional hardening for 1 week at −4°C produced a striking increase in hardiness of barley when applied at all stages of development, while in wheat a great increase in hardiness occurred only where a period of 1–5 weeks at 1·5°C preceded treatment at −4°C. Treatment at −4°C for longer than 1 week did not produce additional hardiness.—R.B.

1642 Allerup, S. **Transpiration changes and stomata movements in young barley plants.** *Physiol. Plant.* 1960, **13**, No. 1, 112–19, bibl. 10, illus. [Plant. Physiol. Lab., R. Vet. Agric. Coll., Copenhagen]

The increase in transpiration which was investigated in young wheat plants (see *Fld Crop Abstr.* 13 : 1065) was shown also to occur in young barley plants. A method was developed for direct microscopy of the stomata over periods of 20 sec. Severing the plant stems induced stomatal opening which resulted in an increase in transpiration. F. s. —s.m.j.

1643 Frey-Wyssling, A. and Buttrose, M. S. **Photosynthesis in the ear of barley.** *Nature, Lond.* 1959, **184**, No. 4704, 2031–2, bibl. 5. [Eidg. Tech. Hochsch., Zürich]

Using the technique recorded in earlier work (*Fld Crop Abstr.* 12 : 1157) data from a study of *Hordeum distichum* var. Prior indicate that products of ear photosynthesis are fully utilized in grain development, and that the maximum value of 76% for this contribution to grain dry weight is a closer approximation to the true value than are the lower values obtained by using the ear shading technique.—M.H.

1644 Guitard, A. A. **The influence of variety, temperature and stage of growth on the response of spring barley to photoperiod.** *Canad. J. Pl. Sci.* 1960, **40**, No. 1, 65–80, bibl. 15, illus. [Canada Dep. Agric., Beaverlodge, Alberta]

Olli and Vantage barley were grown at 55 or 75°F, and given 8-, 16- or 24-hr photoperiods during the following stages of growth of the primary shoot : sowing to internode elongation (stage A) ; internode elongation to earing (stage B) ; earing to maturity (stage C). Increases in the length of photoperiod during stage A reduced the duration of stages A and B, increased the duration of stage C, and reduced plant height, number of leaves produced, weight of stem and ear, straw length, ear length, number of florets and grains per ear, and the percentage of fertile florets. The interval between tiller initiation and stem elongation increased in Olli and decreased in Vantage with

increasing photoperiod. During stage A, more tillers were produced over a longer period under 16-hr days than under 8- or 24-hr days. Increases in the length of photoperiod during stage B increased leaf, stem and ear development and the percentage of fertile florets produced by the primary shoot. Increases in photoperiod during stages B or C reduced the duration of the respective stage and increased the number of fertile tillers per plant. Increasing the temperature from 55 to 75°F reduced the duration and extent of development of the primary shoot, delayed the onset and reduced the duration of tiller initiation, and reduced the number and extent of development of tillers ; the magnitude of these effects decreased with increasing photoperiod. Vantage produced more leaves over a longer period than did Olli. F. S.—R.B.

1645 Skazkin, F. D. and Fomina, N. M. **[Manganese nutrition of plants.]** [Russian] *Doklady Akad. Nauk SSSR (Proc. Acad. Sci. USSR)* 1960, **131**, No. 4, 980–2, bibl. 17. [Leningrad State Pedagogic Inst.]

The effect of Mn on the Viner variety of *Hordeum vulgare*, grown with varying moisture content of the soil at different periods in the plants' ontogeny, was studied during 1954–9. There is evidence that there are two periods during ontogeny when the plant is most sensitive to supplementary Mn supply, namely, at the photophase and at the beginning of grain ripening. During these periods the effect of Mn is beneficial to physiological processes which result in improved quality and quantity of the grain (grain yield increases by 14–19% when Mn is added at the photophase and up to 20% when added at the beginning of grain ripening). Mn has a detrimental effect on barley (lowering grain yield by 10–60%) if it is applied during the period from the appearance of anther protuberances in florets of the central part of the ear to tetrad formation in pollen of the florets on branch stems. Tetrad formation is later on branch stems than on the main stem, and if Mn is applied before this stage is reached on the branch stems, then grain yield is lowered. When soil moisture is deficient during the various phases of development in the barley plant, the influence of Mn is more uniform. It does not affect resistance of the plant to drought if applied at the vernalization phase, but at all other stages Mn increases this resistance, irrespective of the date when it is applied. This is attributed to its effect on the water regime within the plant and to conserving the viability of pollen which, in turn, increases grain yield.—M.H.

1646 Kuthy, S. (A.) and others. Permetezö trágyázás hatása az öszi árpa termés- és fehérjehozamára. **[The effect of top-dressing on the harvest and protein yield of winter barley.]** *Kisérl. Közl.* 1959, **52**/A, No. 2, 93–108, bibl. 21. [Inst. Landw. Qualitätsforsch. Budapest and Ung. Akad. Wissensch., Budapest]

In February 1957, winter barley received an early top-dressing of 280 kg nitrochalk, i.e. 56 kg N, per ha, and subsequently, on 31 May, during flowering, a top-dressing of nitrochalk applied as a spray. The implement used was that normally employed for the control of diseases and pests, the "Rapid-Tox", but so adapted that the spray jet reached a distance of 20–25 m. The area of the experiment covered approximately 0·8 ha ; replication was 4-fold, and the area received about 310 kg nitrochalk (62 kg N) per ha. As the jet could not be evenly regulated, the edges of the area received too much of the fertilizer, resulting in rapid necrosis of the leaves. The plants thus affected were separately harvested, weighed and analysed. Results are shown in tables and comparison is made with a similar trial conducted in 1948, in which, however, the top-dressing was spread by hand. The results from mechanical spraying are superior to those from broadcasting the fertilizer, and are considered especially encouraging since the May dressing had been preceded by a liberal early top-dressing. Although only 40–50% of the N of the May dressing was utilized, an increased yield of 20% grain and 45% straw was achieved, and even in the edge plants which had been burnt the increase in grain yield was also 20%. The increase in pure protein yield was approximately 100 kg/ha in the grain and 75 kg/ha in the straw. F. Ger. S.—G.M.R.

MAIZE

See also Abs. 1748, 1749, 1849, 1921, 2002.

1647 Department of Agriculture, Tanganyika. **The effect of sowing date on yields of maize, soya and groundnuts.** *Rep. Dep. Agric. Tanganyika 1958* 1959, 10–11.

In trials at Ilonga, maize and groundnuts gave the highest yield (1614 and 1442 lb/ac) when sown on 28 Dec. and soyabeans (795 lb/ac) when sown on 11 Dec. Soyabeans sown on 28 Dec. yielded only 499 lb/ac. Where maize was sown later than 28 Dec., grain yields were reduced by up to 80% and total plant weight by up to 50%. —S.M.J.

1648† Stickler, F. C. and Laude, H. H. **Effect of row spacing and plant population on performance of corn, grain sorghum and forage sorghum.** *Agron. J.* 1960, **52**, No. 5, 275–7, bibl. 7. [Kansas Agric. Exp. Sta., Manhattan]

K-1639 hybrid maize and Atlas forage sorghum were grown in 40- or 20-in. rows, and Midland grain sorghum in 10-, 16-, 20-, 24- or 40-in.

rows. In maize and forage sorghum, all 40-in. and some 20-in. spaced plots were cultivated to control weeds, while in grain sorghum only the 40-in. spaced plots were cultivated. Plant densities after thinning were : maize, 15,680 or 10,450/ac ; grain sorghum, 78,400 or 52,300/ac; forage sorghum, 50,000 or 25,000/ac. Where cultivated, grain and stem yields of maize were not significantly affected by stand density or row spacing. The evaporative power of the air within the maize crop was similar in all stands. Uncultivated stands were unsatisfactory. Forage sorghum for silage grew satisfactorily in narrow rows. Yields of grain sorghum at the higher stand density were significantly greater at the 2 narrowest row-spacings than at the widest row-spacing, and greater at the higher than at the lower stand density. The evaporative power of the air within grain sorghum stands at 10-, 16-, 20-, and 24-in. row-spacings was 52, 57, 73 and 78% of that in 40-in. rows.—R.B.

1649 Hoff, D. J. and Mederski, H. J. **Effect of equidistant corn plant spacing on yield.** *Agron. J.* 1960, **52**, No. 5, 295–7, bibl. 2 in text. [Ohio Agric. Exp. Sta., Wooster]

Maize was grown in 42-in. rows or at equidistant spacings (a) in 1957 at 8, 12, 16, 20 or 24 thousand plants/ac on silt loam soil with or without irrigation, and in 1958 at 10, 14, 20 or 28 thousand plants/ac, (b) on silt loam soil containing 9, 12, 22 or 32 lb available P/ac, (c) on silty clay loam soil with or without a mulch of 2 tons wheat straw/ac applied when the plants were 18 in. high. Neither irrigation nor mulching significantly affected yield. Compared with 42-in. rows, equidistant spacing increased average grain yields by (a) 5·5 bu/ac, (b) 10 bu/ac at the lowest level of P and 8 bu/ac at the other 3 P levels, (c) 7 bu/ac. In 1958 but not in 1957, maize at equidistant spacing gave a higher percentage of ears over 4 in. long than did maize in 42-in. rows. The percentage of lodged plants was 2–4% and tended to increase with increasing stand density, but was independent of method of sowing.—R.B.

1650† Eddowes, M. **Maize for silage in the West Midlands.** *Tech. Bull. M1 Harper Adams Agric. Coll. 1959* 1959, pp. 7. [Received Nov. 1959]

An account is given of the growing of maize for silage on a commercial scale in the W. Midlands. It is recommended that seed should be sown at 30–35 lb/ac to give about 9 plants/sq yd in rows 28–33 in. apart. The maize should be sprayed with 2,4-D amine at 16 oz/ac when the plants are 4–6 in. high. Wisconsin 270 and Wisconsin 240 were the most suitable varieties for the W. Midlands, and average yields of 20 tons of green material/ac are possible. F. s.—S.M.J.

1651† Bulletin Technique d'Information. Mission " Mais " en Belgique. [**Mission " Maize " in Belgium.**] *Bull. tech. Inform.* 1960, No. 146, 31–9.

Information is given on maize grown for fodder in Belgium, especially with regard to silage making and varieties. As a result of trials carried out in Belgium and France, the trend is to grow a grain-maize which is harvested 15 days before the grain is completely mature (dough stage). At this stage its nutritive value is highest (about 10,000 F.U./ha). It should be sown at a seed rate not exceeding 40 kg/ha in rows 45–50 cm apart if the maize is to be eaten fresh, or 70–75 cm apart if grown for silage.—E.B.O.

1652 Gard, L. E. **Moisture used by corn on a silt pan soil in southern Illinois.** *Ill. Res.* 1959, **1**, No. 4, 5.

Maize was grown for 3 yr on silt-loam soil and given, (a) no irrigation, (b) 2 in. water at early tasseling and again 10–14 days later, (c) 2 in. water per week, including rainfall, between 7 and 12 weeks after sowing. Treatments (b) and (c) increased maize yields by 27 and 32 bu/ac, respectively. The maize crop obtained (a) 6, (b) 4 and (c) 2% of the water used during the growing season from depths greater than 2 ft below the soil surface.—R.B.

1653 Rintelen, P. Der Maisanbau in betriebswirtschaftlicher Sicht. [**Maize cultivation from the standpoint of farm economics.**] *Bayer. landw. Jahrb.* 1959, **36**, Sonderheft 2, 30–52, bibl. 10, illus. [Inst. f. Wirtschaftslehre des Landbaues, Techn. Hochsch. München, Weihenstephan, Bavaria]

Experiments at the above Institute demonstrated that where the average air temperature between May and Sept. does not fall below 14·5°C, the cultivation of hybrid maize is profitable. This is because maize cultivation is highly mechanized, it can be harvested over a period of 8 weeks (mid-Oct. to mid-Dec.), and it allows flexibility in the use of labour. For a similar outlay, and deducting drying costs, the financial return from grain maize is one-third higher than from other cereals. Maize cultivation is recommended for medium-sized to large farms which experience shortage of labour.—D.B.

1654 Gasanov, T. M. [**Varietal study of maize for stubble sowings in the Kuba-Hačmas irrigation zone.**] *Doklady Akad. Nauk Azerbaidžan SSR* (*Proc. Acad. Sci. Azerbaidžan SSR*) 1960, **16**, No. 1, 77–9, Russian summary.

In this region [approx. 41°N., 48°E.] stubble sowings are important because of the early harvest of the main crop. A study of *Zea mays* varieties during 1957–8 showed that the greatest yield of

green matter was obtained with the late-ripening Zakatal'skaja (yellow flint) and VIR 156, among others ; of the medium-early ripening types, the best were VIR 37 and VIR 267. The greatest number of ears attained the milk/wax stage of ripeness in the medium-early types VIR 267, VIR 37 and Osetinskaja (white tooth) ; of the late-ripening types which attained milk-ripeness among the best were VIR 156 and Krasnodarskiĭ 5. F. Russ. S.—M.H.

1655 JOHNSON, R. A. and MENDOZA, N. Clasificación mecánica de maíz para semilla. [**Sizing seed maize by machine.**] *Agron. trop., Maracay* 1958, **8**, No. 3, 85–108, bibl. 1, illus., English summary. [Serv. Shell Agric., Cagua, Aragua, Venezuela] [Received Apr., 1960]

The results are given of an investigation with the maize varieties Venezuela 1, Venezuela 3, Sicarigua, Sicarigua Improved, and the new hybrids Guaicaipuro, Tiuna and Mara, with a view to establishing a practical procedure for dividing seed maize into sizes according to width, thickness and length of the grain. Seed of uniform size is required for mechanical sowing.—E.B.O.

1656 JAKOVENKO, V. A. and TORŽINSKAJA, L. R. [**The biochemical properties of hybrid maize at different phases of ripening in relation to storage and drying conditions.**] [Russian] *Doklady Akad. Nauk SSSR, (Proc. Acad. Sci. USSR)* 1960, **131**, No. 4, 976–9, bibl. 13.

In this study of the maize hybrid VIR-42, there is confirmation that drying the grain at different stages of ripeness lowers the activity of enzymes to the level of that at post-harvest-ripeness. This lowering is greatest by drying at milk- and wax-ripeness, and less by drying at full ripeness. It is concluded that : (1) the present method for determination of enzyme activity is unsuitable as a method for evaluating grain quality in dried maize ; (2) prolonged drying of grain at 50°C does not lower germination capacity ; (3) neither germination in the field nor yields from dried grain are dependent on stage of grain ripeness ; and (4) a high moisture content of grain when at different stages of ripeness does not affect dried grain quality. The use of dried, unripe maize grain facilitates early harvesting and is of value for regions where maize does not ripen completely.—M.H.

1657 FUNDERBURK, H. H. and DAVIS, D. E. **Factors affecting the response of *Zea mays* and *Sorghum halepense* to sodium 2,2-dichloropropionate.** *Weeds* 1960, **8**, No. 1, 6–11, bibl. 12. [Alabama Agric. Exp. Sta., Auburn]

In trials in which 2 or 8 lb Na dalapon/ac were applied at 3 dates to plots of maize sown on 5 dates, the 8-lb rate retarded increase in height of the maize by decreasing the length rather than the number of internodes at all stages of growth and dates of application. At the 1st spraying on 9 April, the 2-lb rate was as toxic as the 8-lb rate, but not at later sprayings. The absorption and translocation of dalapon by maize roots, as measured after dipping for 5 sec in a 5000 ppm solution, was more efficient than that of the shoots. Where dalapon was applied at 5 or 20 lb/ac to *Sorghum halepense* plants 3, 6, 9 or 12 weeks old, maximum toxicity was obtained in plants treated when 3 or 6 weeks old.—S.M.J.

1658 YOUNG, W. R. and CANDIA, Z. D. **Studies with chemical seed treatments as bird repellents for the protection of germinating maize in the Mexican tropics.** *Pl. Prot. Bull.* 1960, **8**, No. 4, 37–42, bibl. 4, illus. [Mex. Agric. Progr. Rockfeller Found., Mexico, D.F.]

The results of these studies indicated that treatment of maize seed with 3–5% thiram dust, 3–5% thiram liquid with sticker, 1% spreader-sticker at 6 cc per 100 g of seed, and drinox at 0·5–1 cc per 100 g of seed was relatively effective for repelling birds from germinating maize in the Veracruz area. Treatment with thiram dust is convenient with small lots of seed because it can easily be dusted into seed envelopes before sowing. Liquid treatments with spreader-sticker, drinox, or the spreader-sticker plus thiram mixture may be of use where large quantities of seed are to be treated. Spreader-sticker and drinox are cheaper than thiram. F. concl.—E.B.O.

1659 RAI, K. D. **Zinc sulphate as a corrective of chlorosis in maize on the heavy alkaline soils of the Central Rainlands, Tozi, Sudan.** *Indian J. Agron.* 1959, **4**, No. 2, 82–91, bibl. 12. [Tozi Agric. Res. Sta., Sudan]

1660 BELLMANN, K. and others. Einflüsse des Kleinklimas auf den Maisbestand. [**Influence of local climate on maize stands.**] *Biol. ZBl.* 1960, **79**, No. 3, 279–84, bibl. 2. [Inst. PflZücht. und Agrarmeteorologische Forschungsstation, Gross-Lüsewitz, E. Germany]

Maize plots (a) on sandy soil, (b) on sandy loam, were in the vicinity of a 35-ft high coniferous forest. Changes in growth rate of maize corresponded with variations in air temperature, wind velocity, air humidity and soil moisture.—D.B.

1661 VILMORIN, R. de. Expériences sur la germination des graines de maïs. [**Trials on the germination of maize seeds.**] *C.R. Acad. Agric. Fr.* 1960, **46**, No. 3, 102–4.

Trials were carried out by a farmer in Anjou, France, to investigate the cause of the frequent failures of germination in the field, of maize seed

known to be sound and of a high germinating capacity. There was indication that, with or without the presence of pathogenic fungi, the emergence of maize seed can be impaired by excess water in the soil soon after sowing, while the effect of cold was not important. An excess of water in the soil can also increase the phytotoxicity of preparations used for treating the seed.—E.B.O.

1662 Murdy, W. H. **The strengthening system in the stem of maize.** *Diss. Abstr.* 1959, **20,** No. 6, 1993–4. [Washington Univ., Saint Louis, Missouri]

A description is given of the structural components concerned with providing support and rigidity to the stem of maize and of the closely allied genera *Euchlaena* and *Tripsacum*. *Euchlaena* was structurally similar to, though weaker than, 5 out of 6 maize varieties examined. *Tripsacum* showed considerable development of the strengthening system of the stem and differed in tissue arrangement from maize and *Euchlaena*.—P.J.B.

1663 Fisher, F. L. and Smith, O. E. **The influence of nutrient balance on yield and lodging of Texas Hybrid Corn No. 28.** *Agron. J.* 1960, **52,** No. 4, 201–4, bibl. 6. [Texas Agric. Exp. Sta., College Station]

Maize, var. Texas Hybrid 28, was grown for 3 yr on fine sandy loam with 0, 40, 80 or 120 lb N/ac, 0, 40 or 80 lb P_2O_5/ac, and 0, 40 or 80 lb K_2O/ac/yr in all combinations of NPK rates. A heavy crop of cowpeas was ploughed in as green manure before the first maize crop. N had no significant effect on yield, but P and/or K significantly increased yields of grain. Percentage lodging was significantly increased by N with or without P, and significantly reduced by K alone or in combination with the other nutrients. Symptoms of K deficiency were present on plots receiving 0 or 40 lb K_2O/ac. F. S.—R.B.

1664 Denmead, O. T. and Shaw, R. H. **The effects of soil moisture stress at different stages of growth on the development and yield of corn.** *Agron. J.* 1960, **52,** No. 5, 272–4, bibl. 7. [Iowa Agric. Exp. Sta., Ames]

Maize plants were grown in pots in the field and subjected to moisture stress during the following stages of growth, in all combinations : (a) between 30 and 60 days after sowing, i.e. until tassel emergence, (b) from the onset of tassel emergence until 5 days after 75% of plants had produced silks, a period of 17 days, (c) for 30 days after silking. Moisture stress consisted of 3 periods of 2–3 days during which less than 50% of the moisture available at field capacity was present in the soil. Control plants were adequately watered. Growth was retarded by soil moisture stress but was resumed when water was supplied. Moisture stress during stage (a) reduced plant height and dry-matter production. Treatments (a) (b) and (c) reduced grain yields by 25, 50 and 21%, respectively. Effects produced by combinations of treatments were additive. It was suggested that moisture stress reduced yields during the early stages of growth by reducing the extent of the photosynthetic surface, and during later stages of growth by reducing the rate of assimilation. F.s.—R.B.

1665 Bauman, L. F. **Relative yields of first (apical) and second ears of semi-prolific southern corn hybrids.** *Agron. J.* 1960, **52,** No. 4, 220–2. [Crops Res. Div. USDA and Georgia Agric. Exp. Sta., Tifton]

Experiments with semi-prolific maize hybrids indicated that most of the variation in yields resulted from differences in yield of second ears where a significant number of these were present. Yields of first ears were relatively unaffected by environment except under extremely adverse conditions. Preventing pollination of first ears reduced yields per plant by 157 g (53%) and increased yields of second ears by 50 g, while preventing pollination of second ears reduced yields by 83 g and increased yields of first ears by 8 g. Where up to 6 leaves were removed per plant, the production of second ears was greatly reduced or nearly eliminated before yields of first ears were decreased. Yield data from 10 varieties of hybrid maize grown at 3 locations indicated that (a) hybrids differed more in yields of second ears than in total yields or yields of first ears, (b) hybrids with high yields of second ears tended to produce smaller first ears than those with low yields of second ears. F. S.—R.B.

1666 Moss, D. N. **Photosynthesis of corn under field conditions.** *Diss. Abstr.* 1959, **20,** No. 6, 1944–5. [Cornell Univ., Ithaca, New York State]

Maize was grown in the field in portable plastic growth chambers to study the effect of climatic variables on its rate of photosynthesis. Under conditions of high fertility and ample soil moisture, light intensity was the factor most restrictive of growth and in these experiments maize did not reach a condition of light saturation even at full mid-summer daylight. Apparent photosynthesis increased as temperatures increased up to levels greater than 100°F. Though the net assimilation of CO_2 increased as the concentration of CO_2 in the atmosphere rose, it did so at a much lower rate. Maize growing in a non-renewed atmosphere, in full sunlight, was able to deplete the atmospheric CO_2 concentration to a level of 15 ppm. The amount of CO_2 escaping from the soil in these experiments remained relatively constant at about 3·5 lb/ac/hr. On clear days, 95%

of the CO_2 absorbed by the plants came from the atmosphere. In dry soils, the rate of photosynthesis declined during the mid-day hours when the moisture requirements of the plants were highest. The range of CO_2 concentrations in the atmosphere near the vegetative cover was 250 to 390 ppm and was highest on cloudy days. The assimilation rates of leaves declined as they matured and the rate of decline increased markedly as the maize ears approached maturity.—P.J.B.

1667 Faludi, B. and others. **Increased photosensitivity of leaf pigments and its relation to the respiratory system in albino mutants of corn.** *Physiol. Plant.* 1960, **13,** No. 2, 227-36, bibl. 33. [Eötvös Loránd Univ., Budapest]

Albino maize plants grown in darkness developed green leaves, but exposure to strong light resulted in the complete bleaching of the leaves within a few hours. The pigment destruction was an oxidative process and the increased light-sensitivity of the albino plants may have been due to the abnormal carotenoid content of the tissues.—S.M.J.

1668 Denmead, O. T. and Shaw, R. H. **Evapotranspiration in relation to the development of the corn crop.** *Agron. J.* 1959, **51,** No. 12, 725–6, bibl. 7. [Iowa Agric. Exp. Sta., Ames]

A study was undertaken to determine the period during the growing season of maize when current procedures for estimating evapotranspiration from meteorological elements might be applied successfully. The ratio of evapotranspiration from maize to open-pan evaporation was calculated at different periods of the growing season. Soil moisture data were collected at 11 sites throughout Iowa over 5 growing seasons. Before silking, the ratio increased in a sigmoid manner from 0·36 at the average sowing date to 0·81 at silking. It remained constant at 0·81 for 16 days after silking and then declined, at first gradually, then rapidly. It is suggested that the changing ratio is due to increasing leaf area until silking and to declining physiological activity of the crop soon after the commencement of ear growth. Since current procedures for estimating evapotranspiration require that the crop shall be actively growing and completely shading the ground, it is concluded that these procedures can be applied to maize during a period of only 2–3 weeks during its growing season. F. s.—A.M.H.

1669 Cherry, J. and others. **Effect of gibberellic acid on growth and yield of corn.** *Agron. J.* 1960, **52,** No. 3, 167–70, bibl. 5, illus. [Illinois Agric. Exp. Sta., Urbana]

Maize, var. WF9 × M14 and Hy2 × O7, was sprayed with 10, 50, 100 or 200 ppm GA at weekly intervals (a) from sowing to maturity, (b) from pollination to maturity, or once with 100 ppm GA (c) at the seedling stage, (d) when plants were 3 ft tall, (e) 2–3 days before pollination or (f) 2 weeks after pollination. The 2nd or the first 3 ear sheaths were injected weekly or twice weekly, beginning at pollination, with 1 mg GA per ear sheath. Treatment (a) decreased leaf area, markedly decreased tillering, and increased plant height, number of nodes per plant and height to the first ear node. The 2 highest concentrations of GA, applied at weekly intervals, retarded silking and frequently caused male sterility. The effect of GA on internode elongation was most marked in the internodes near the base of the stem and those directly below the tassel. GA tended to increase the weight of stems plus leaves at maturity, especially in plants where treatment was begun near the end of the growing season. Treatments (a) and (b) reduced grain yields of Hy2 × O7 and reduced the number of first ears and tiller ears produced, while treatment (b) reduced the number of second ears produced and treatment (a) reduced ear length and cob weight. GA treatments had no effect on the number of ears produced by WF9 × M14, and grain yields of this variety were reduced only where 200 ppm GA were applied. Treatment (e) increased grain yields slightly. Injections of 1 mg GA into the second ear sheath slightly increased grain yields of WF9 × M14, while injections into the first 3 year sheaths decreased grain yields in both varieties. GA had no effect on grain weight, grain protein content or grain oil content in either variety.—R.B.

1670 Schick, R. and others. Über die Phänometrie des Maises. [**Measurement of growth phenomena in maize.**] *Züchter* 1960, **30,** No. 3, 97–101, bibl. 3. [Inst. PflZücht. und Agrarmeteorol. Forschungsstation, Gross-Lüsewitz, E. Germany]

Diagrams show the dependence of leaf growth and rate of earing on temperature, velocity of wind and soil moisture. Optima were : day temperature, 22–25°C ; night temperature, 18°C ; soil moisture, 20% ; wind velocity, 0·5 Beaufort. F. Ger. s.—D.B

1671 Larson, W. E. and others. **Effect of subsoiling and deep fertilizer placement on yields of corn in Iowa and Illinois.** *Agron. J.* 1960, **52,** No. 4, 185–9, bibl. 10, illus. [Agric. Res. Serv. USDA, and Iowa Agric. Exp. Sta., Ames]

In 11 experiments on 7 soil types in Iowa in 1955–8, subsoil tillage 16 or 24 in. deep did not increase maize yields to a significant extent. Tillage to 24 in. significantly reduced yields in 2 of the experiments. In 8 experiments on 5 soil types in Illinois, tillage 18 in. deep in autumn 1954 increased maize yields in 1955 but not in 1956 in

one trial, and in 1956 but not in 1955 in another trial. At one location in Iowa, N and P_2O_5 each at 80 lb/ac, either ploughed in or placed 20 in. deep, significantly increased maize yields. At another location, P_2O_5 at 120 lb/ac produced greater yields of maize during the first 2 years after application, and greater yields of oats during the 3rd year, where the fertilizer was ploughed in than where it was placed 16 or 24 in. deep. P_2O_5 at 80 lb/ac did not increase maize yields in the other Iowa experiments.—R.B.

1672 Cervato, A. Sulla concimazione del mais. [**Maize manuring.**] *Ann. Fac. Agr., S. Cuore* 1959, **76**, No. 3, 57–75, bibl. 7, English and French summaries.

In manurial trials on maize in 1958–9 in Cremona province, N. Italy, the highest yield, 9035 kg of grain (15·5% moisture) per ha, was obtained by applying 30,000 kg of f.y.m. per ha plus ammonium nitrate (60 kg N/ha), half of the nitrate being applied at sowing and half as a top dressing.—E.B.O.

1673 Caswell, G. H. and Clifford, H. T. **The effect of moisture content on the germination and growth of fumigated maize grain.** *Emp. J. exp. Agric.* 1960, **28**, No. 110, 139–44, bibl. 3. [Dep. Agric., Univ. Coll., Ibadan, Nigeria]

The viability of stored maize was affected both by its moisture content and by fumigation with a mixture of CCl_4 and $C_2H_4Cl_2$. During the first 3 months of storage unfumigated grain at a moisture content of $< 13\%$ maintained its viability. At higher moisture contents viability was not maintained, the rate of loss increasing with moisture content. The viability of fumigated grain was maintained for 3 months if its moisture content was below about 11%, above this level the rate of loss of viability was comparable with that for unfumigated grain above 13% moisture content. Growth of unfumigated grain as measured by height or weight was unrelated to moisture content, but with fumigated grain there was a depression of growth which increased with moisture content over the range tested. F. S.—S.M.J.

SWEET-CORN

1674 Harris, E. D. Jr. ***Hyperodes humilis*, a new pest of sweet corn in the Everglades, and its control.** *J. econ. Ent.* 1960, **53**, No. 2, 251–7, bibl. 12, illus. [Florida Everglades Exp. Sta., Belle Glade]

DDT at 2 lb/ac or guthion at 1 lb a.i./ac in 100 gal water/ac, applied as a spray to the soil and the lower part of stems of sweet-corn in each of 7 applications at 4-day intervals, were the best of 11 insecticides applied to control larvae of the stem-boring weevil *Hyperodes humilis*. They reduced the number of infested plants from 56% to 3–10%.—R.B.

SORGHUMS AND OTHER MILLETS

See also Abs. 1648.

1675† Rojas, E. and Gross, D. Cultivo de sorgo forrajero, variedad Sugar Drip. [**Cultivation of fodder sorghum var. Sugar Drip (in Peru).**] *Bol. trim. Exp. agropec., Lima* 1959, **8**, No. 4, 21–8, bibl. 3. [Esta. Esp. Agríc., La Molina, Peru]

1676 Everly, R. T. and Pickett, R. C. **The effect of phorate applied to seed on the growth, development and insects attacking grain sorghum.** *J. econ. Ent.* 1960, **53**, No. 1, 154–60, bibl. 13. [Purdue Univ. Agric. Exp. Sta., Lafayette, Indiana]

Stands and yields of RS610 grain sorghum were significantly reduced, and pollen shedding was delayed, where seed was treated with 2 or 4 lb a.i. phorate (= thimet) per 100 lb seed. In glasshouse trials, phorate reduced stands by 26·5% and prolonged seed germination by 3 days. Germination of treated seed was greatly reduced after 10 months' storage. Arasan at 10·7 oz/100 lb seed reduced phorate-induced phytotoxicity. Plants from seed treated with arasan, with or without phorate at 0·5 or 1 lb a.i./100 lb seed, matured grain earlier than untreated controls, while plants treated at higher rates of phorate matured later. Where yields were corrected for differences in stand, yields from plots treated with 1 or 2 lb phorate, or 1 lb phorate plus arasan, were significantly lower than those from untreated plots. Treatments had no significant effect on the percentage germination of harvested seed. Phorate reduced infestations of *Rhopalosiphum maidis* by 75%.—R.B.

1677 Dupuy, M. Possibilités de production de cellulose à partir du sorgho dans le sud-ouest. [**Possibilities of producing cellulose from sorghum in south-west France.**] *C.R. Acad. Agric. Fr.* 1960, **46**, No. 4, 157–62, bibl. 5. [Éc. Nat. Agron. Toulouse, France]

A study was made of morphological, anatomical and biological characteristics of sorghum types which are of interest for the production of cellulose. Their cultural methods, and the course of cellulose formation, were also investigated. The types most suitable for the production of cellulose belong to the species *Sorghum dochna* var. *technicum*. Under favourable conditions sorghum yields 13–18 tons dry matter/ha, or about 4 tons dry cellulose paste/ha, as well as 2000–3500 kg of grain.—E.B.O.

1678 Nordin, P. **Sorghum grain. The soluble sugars.** *Trans. Kans. Acad. Sci.* 1959, **62,** No. 3, 212–15, bibl. 16, illus. [Kansas Agric. Exp. Sta., Manhattan]

The principal sugars contained in ungerminated grain of Pink Kafir sorghum were fructose, sucrose, glucose, raffinose and stachyose. Pink Kafir sorghum seed was germinated at 30°C. for 5, 12, 24, 36, 48, 72 or 96 hr. Raffinose and stachyose were completely metabolized in the early stages of germination. The concentration of sucrose in the grain declined during the first 36 hr of germination and then increased. The ratio of fructose to glucose in the grain decreased as germination progressed.—R.B.

1679 Cheng Wang, I. and others. **The phytin content of sorghum grain.** *Trans. Kans. Acad. Sci.* 1959, **62,** No. 3, 208–11, bibl. 12.

The phytin content of the grain of 7 varieties of grain sorghum is given.—R.B.

1680 Stanway, Viola. **Germination of *Sorghum vulgare* Pers. at alternating temperatures of 20-30°C and 20-35°C.** *Proc. Ass. off. Seed Anal. N. Amer.* 1959, **49,** No. 1, 84–7, bibl. 4. [Univ. Missouri, Columbia]

Germination tests were carried out at 20°C for 16 hr/day and 30 or 35°C for 8 hr/day on 50 samples of sorghum seed, 34 of which were freshly harvested. Some of the seeds were germinated at 5–10°C for 5 days before being transferred to the higher temperatures. Percentage germination at alternating temperatures of 20/35°C was significantly greater than that at 20/30°C. Preliminary cooling significantly reduced percentage germination.—R.B.

1681 Niqueux, M. Relations entre certains caractères de la panicule et le rendement chez *Sorghum elegans* (Snow.). [**Relationship between certain characters of the panicle and yield in *S. elegans*.**] *Agron. trop., Paris* 1960, **15,** No. 1, 47–53, bibl. 11, illus., English and Spanish summaries.

1682 Gopalakrishnan, S. **Copper nutrition of millets.** [1] *Madras agric. J.* 1960, **47,** No. 2, 53–62. [Agric. Coll. and Res. Inst., Madras, India]

The effect of Cu at 0, 10, 20, 50 and 100 ppm on germination, plant height, leaf area, time of flowering, dry-matter production, chemical composition at different stages of growth, and yields of grain, straw and roots was studied in *Sorghum vulgare*, *Eleusine coracana* and *Pennisetum typhoideum*. The optimum concentrations of Cu in the growing medium for these species were, respectively, 20, 50 and 50 ppm.—D.B.

1683† Shah, H. G. and Mehta, B. V. **Comparative studies on the effect of ammonium chloride and other fertilizers on the yield and crude protein content of pearl millet (*Pennisetum typhoides* Stapf and Hubbard).** *Indian J. Agron.* 1959, **4,** No. 2, 105–13, bibl. 18. [Inst. Agric., Anand, Bombay State]

On light sandy loam (goradu soil) yields responded significantly to N over 3 seasons. Yields were higher with NH_4 sulphate-nitrate, NH_4NO_3 and urea than with NH_4Cl or $(NH_4)_2SO_4$. Organic manures gave the lowest yields. 40 lb N/acre gave higher yield increases than 20 lb/acre did. P gave no yield responses alone or with N. The recovery of N in the grain and straw decreased with increasing N. No significant difference in crude-protein content was observed. NH_4Cl was not inferior to $(NH_4)_2SO_4$ for yield or crude-protein content. From *Soils and Ferts* 23 : 1388.—D.B.

RICE

1684 Trivulzio, G. Risicoltura in Francia. [**Rice-growing in France.**] *Riso* 1960, **9,** No. 3, 6–9, No. 6, 6–9 and No. 7, 3–6, illus.

1685 du Pasquier, R. Riziculture en Iran. [**Rice-growing in Iran.**] *Riz et Rizicult.* 1960, **6,** No. 1, 5–10, bibl. 6, illus., English and Spanish summaries.

1686 Piacco, R. Prove sul trapianto del riso. Influenza del grado di investimento unitario di piantine sulla produzione in granella. [**Trials in transplanting rice. Influence of plant density on grain yield.**] *Ann. Sta. sper. Risicolt., Vercelli 1955* 1959, **3,** 57–66, bibl. 1, illus., English and French summaries. [See *Fld Crop Abstr.* 10 : 940.]

1687 Sampietro, G. Ricerche sull'irrigazione del riso. [**Investigations on rice irrigation.**] *Ann. Sta. sper. Risicolt., Vercelli 1955* 1959, **3,** 9–50, illus., English and French summaries.

The results are given from the second year of trials on rice irrigation in Italy. Because of a normal climate and of improvements in carrying out the trials, these results, although not yet conclusive, are considered more reliable than those obtained in the previous year [see *Fld Crop Abstr.* 10 : 1335]. The grain yields obtained in 1955 after the following treatments were, in kg/ha : submersion, 6565; imbibition, 6635 ; 75% watering, 6275, and 50% watering, 3360.—E.B.O.

1688 Harrell, A. T. and Faulkner, M. C. **Rice irrigation in Louisiana.** *Rice J.* 1960, **63,** No. 5, 24–5 and 34. [Rice Exp. Sta. Crowley, Louisiana]

1689 Bulanadi, J. and Aldaba, P. V. **The effects of submergence depth upon the growth and the yield of lowland rice in the Maligaya Rice Experiment Station.** *Philipp. J. Agric.* 1957, **22**, Nos 1–4, 121–45, bibl. 6, illus. [Publ. 1959] [Bur. Pl. Indust., Philipp. Dep. Agric., Manila]

Rice, var. Apostol, Macan, Raminad 3 and Wagwag, sown on 24 June 1955, was grown on plots flooded to a depth of 0, 5, 10, 15 or 20 cm from 17 Aug. until Apostol reached the dough stage. Half of the plots were flooded continuously, while the remainder were given a cycle of 15 days' flooding and 5 days' drainage. Depth of submergence had little effect on growth or yield. Under continuous flooding Apostol yielded 63·8 cavans/ha, Macan 54·8 cavans/ha, Raminad 70·1 cavans/ha, and Wagwag 71·9 cavans/ha, while under intermittent flooding grain yields of the 4 varieties were 80·9, 67·2, 72·5 and 73·5 cavans/ha, respectively. [1 cavan = 44 kg]—R.B.

1690 Urano, K. and others. **Studies on the irrigation and the deep plowing. 1. On the growth and yields of upland rice and soybean plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 236–8, bibl. 8, English summary. [Kikyogahara Branch, Nagano Agric. Exp. Sta.]

In upland rice, irrigation, deep ploughing and heavy manuring increased length of culm and ear, number of ears, percentage of ripened grain and 1000-grain weight. In soyabean, each of these treatments increased length of stem, the number of fertile pods and fertile seeds per plant. The effects of these treatments were more obvious on upland rice than on soyabean. F. Eng. s.—D.B.

1691 Brown, F. B. **Rice variety trials in Malaya, 1954-58.** *Bull. 109 Dep. Agric. Fed. Malaya* 1959, pp. 80, 1 map. [Received April, 1960]

The results are given of 54 trials carried out at 39 stations and including 69 rice varieties. Varieties thought to merit further trial are listed. —A.M.H.

1692 Silva, M. V. and Mendes, F. P. 'Lusitano'. Uma nova forma cultivada de arroz. **[Lusitano, a new cultivated form of rice.]** *Agron. lusit.* 1959, **21**, No. 1, 5–17, bibl. 3, illus., English and French summaries. [Esta. Agron. Nac. Sacavém, Portugal]

A botanical description is given of the rice hybrid Lusitano (Allorio × Arroz da Terra) which is included in the ssp. *japonica*, var. *italica*, type *media*. Biometrical and field data, and results of chemical and technological analyses, are also reported. F. s.—E.B.O.

1693 Corbetta, G. Prova di concia del seme di riso in campo. **[A trial in treating rice seed in the field.]** *Riso* 1960, **9**, No. 3, 17–18, illus. [Sta. Sper. Risicolt., Vercelli, Italy]

A trial was carried out to test 5 preparations for treating seed of the rice var. R. Bersani of 99·5% germinating capacity. Two days after treatment, treated and untreated samples of about 200 seeds each were sown in the field in special germination trays. Results showed that treatment with (1) copper oxide at 50 g per 100 kg of seed, or (2) an organo-mercury preparation at 43 g of mercury per 100 kg of seed, was best and gave about 8 and 7% more healthy seedlings, respectively, than the untreated controls.—E.B.O.

1694 Duarte, A. J. S. and others. Estudo da germinação do arroz sob a acção de alguns produtos fungicidas e da provável influência dos processos de amostragem. **[Study on the germination of rice treated with certain fungicides and on a probable influence of sampling processes.]** *Agros, Lisboa* 1960, **43**, No. 1, 13–31, bibl. 7, English and French summaries.

Rice seed was treated with 13 fungicides (named) which were used at the commercial rate or at 0·5, 1·5, and 2 times this rate. The samples consisted in each case of 100 seeds taken from 0·5 or 1 kg of disinfected seed. The seeds were germinated in Petri dishes with 20 ml of water, at 32°C, immediately after treatment, or after being kept in close contact with the fungicides for 6 days. Results showed that : (a) germination was affected by treatment and sampling ; (b) treatment of 1 kg of seed was sufficient for practical conclusions to be drawn ; (c) none of the fungicides inhibited germination, but some delayed germination, especially when they remained in contact for a long time with the seed, while others had an accelerating effect.—E.B.O.

1695 Ciferri, R. Le associazioni di malerbe delle zone risicole periferiche e delle risaie stabili. **[The weed associations in marginal rice areas and in permanent rice-fields (in N. Italy).]** *Riso* 1960, **9**, No. 3, 15–16.

1696 Baker, J. B. **An explanation for the selective control of barnyard grass in rice with CIPC.** *Weeds* 1960, **8**, No. 1, 39–47, bibl. 7, illus. [Louisiana State Univ., Baton Rouge]

It is suggested that selective control of barnyard grass (*Echinochloa* sp.) in rice by CIPC is due to the fact that rice seedlings develop their 1st node well below the soil surface, whereas barnyard grass develops its 1st node near the soil surface and is therefore more vulnerable to the herbicide.—S.M.J.

1697 Smith, R. J. and others. **Progress in weed control in rice production in the**

United States. *Internat. Rice Comm. News Lett.* 1959, **8**, No. 3, 1–6. [Arkansas and California Agric. Exp. Sta.]

The results of 5 years of investigations on the control of weeds in the rice areas of Arkansas and California are discussed. A method for controlling barnyard grass (*Echinochloa* spp.) and other weed grasses involving the use of CIPC in combination with several cultural practices, was applied effectively on more than 5000 ac of rice in 1959. Fundamental investigations have been conducted on the use of 2,4-D, MCPA, 2,4,5-T and silvex for controlling broad-leaved weeds and sedges without damaging the rice. It is estimated that more than 40% of the total rice area in the USA is treated annually with phenoxy-type herbicides. F. s.—E.B.O.

1698 George, K. **Chemical control of weeds in the paddy fields of West Bengal.** *Trans. Bose Res. Inst.* 1956–8, **21**, 9–12, bibl. 10, illus.

With an optimum dosage of 5 lb of Crag herbicide 1 per acre, control of most of the annual weeds in paddy fields was possible without the serious crop injury that is usually associated with other 2,4-D and MCPA formulations. At a later stage in the life of rice treated with Crag, it was observed that there was increased vegetative growth and it is concluded that some growth-promoting substances are formed during the biological activation processes undergone by this growth regulator. F.s.—D.B.

1699 Thung, T. H. Hoja blanca, een schadelijke virusziekte bij de rijstcultuur. **Hoja blanca (white leaf), a harmful virus disease of rice.** *Landbouwk. Tijdschr., Wageningen* 1960, **72**, No. 8, 290–5, bibl. 4.

The symptoms and mode of dispersal of hoja blanca are described and a short review is given of research on varietal resistance to the disease.—R.B.

1700 Spreafico, L. L'analisi della germinabilità del riso. [**The analysis of germinating capacity of rice.**] *Ann. Sper. agr.* 1960, **14**, No. 1, 117–52, bibl. 22, illus., English summary. [Ente Naz. Sementi Elette, Lodi, Italy]

From germination tests with rice seeds it was concluded that : (a) vermiculite was the best substratum for determining both the germinating capacity and germinating energy ; (b) the best conditions with filter papers in Petri dishes (diameter 12 cm) were obtained by using one filter with 8–10 ml of water or 2 filters with 12 ml of water ; (c) a constant temperature of 28°C was best.—E.B.O.

1701 Weir, H. L. **Some observations on the germination of rice seed.** *Proc. Ass. off. Seed Anal. N. Amer.* 1959, **49**, No. 1, 80–1. [Arkansas State Plant Board, Little Rock]

Most of the rice samples in Arkansas which have exhibited seed dormancy were of the varieties Nato and Bluebonnet 50. Samples of rice seed (a) untreated, (b) cooled to 5°C for 5 days, (c) dried at 40°C for 4 days, were germinated at alternating temperatures of 20°C [16 hr/day] and 30°C [8 hr/day]. Only method (c) caused breaking of dormancy, and that not completely. Freshly harvested seed samples were germinated at alternating temperatures of (a) 20/30°C, (b) 30/45°C, or (c) a constant temperature of 30°C, or (d) stored for 4 weeks and germinated at 20/30°C. Treatment (b) readily broke dormancy, but increased the percentage of abnormal seedlings. Treatment (c) gave germination comparable with that from treatment (d) and germination was complete within 10 days.—R.B.

1702 Roberts, E. H. **The effect of gamma BHC on the growth of rice seedlings.** *Emp. J. exp. Agric.* 1960, **28**, No. 110, 133–8, bibl. 8, illus. [W. Afr. Rice Res. Sta., Rokupr, Sierra Leone]

Rice seed stored in contact with dressings containing BHC accumulated γ-BHC (and probably other isomers present). After 2 months' storage, deformities appeared on germination and after 9 months' storage these deformities reached a level of severity which was equivalent to growing undressed seed in solutions containing between 29·1 and 291 ppm γ-BHC. The percentage germination was not affected. The results are discussed in relation to other work on the effects of γ-BHC on plant growth. F. s.—S.M.J.

1703 ten Have, H. Enkele waarnemingen over de uitstoeling van het rijstgewas. **Some experiments on the tillering of the rice crop.** *Surinaam. Landb.* 1959, **7**, No. 3, 59–68, bibl. 2, English summary. [Stichting Machinale Landb. Suriname, Paramaribo]

Rice was sown at 35, 60, 85, 110 or 135 kg seed/ha, and 20, 30, 35, 40 or 50 kg N/ha was applied 46–48 days after sowing (lowest 2 rates of N) or as split applications 46–48 or 67–69 days after sowing. The number of productive tillers per plant decreased with increasing seed rate from 4 tillers/plant at the lowest seed rate, to 1·1 at the highest rate. The number of productive panicles per m^2 increased slowly with increasing seed rate. Favourable growing conditions markedly increased the number of tillers per plant only at the lowest seed rate. Applications of N effectively stimulated tillering at the lower 2 seed rates. Dima rice produced more fertile tillers/plant than did Nickerie at the lowest seed rate only. No differences in the extent of rice tillering were observed where seed was sown in the major (April) or minor (end of Oct.) rainy seasons.—R.B.

1704 Nagai, T. and Matano, T. **Cultivated rice varieties viewed from root characters. 4. Interrelations among root activity, ferrous coating formation and cation-exchange capacity.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 208–10, bibl. 3, English summary. [Kyoto Univ.]

1705 Nishikawa, G. and others. **Studies on branching habits in crop plants. 1. On the differentiation and development of tillering buds in lowland rice seedlings grown under different seeding spaces.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 191–3, [Tokyo Univ. of Education]

Tiller growth is suppressed in densely planted rice seedlings (1·5 × 1·5 cm), compared with sparsely planted seedlings (4·5 × 4 cm). F. Eng. s. —D.B.

1706 Ogura, T. **Studies on ligule and auricle of 1st leaf of rice plant.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 194–6, bibl. 4, illus., English summary. [Tokyo Univ. Agric. and Technol.]

1707 Kawahara, H. and others. **Observation on the differentiating process of panicle in rice plant by dissecting binocular microscope.** *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 197–200, bibl. 13, illus., Japanese summary. [Ibaraki Univ.]

The development of the leaf and panicle of rice, as observed through the binocular dissecting microscope, is described and illustrated and compared with wheat. The processes involved in leaf production are similar in wheat and rice, but not those of development of reproductive organs.—D.B.

1708 Matsushima, S. and Manaka, T. **Analysis of developmental factors determining yield and its application to yield prediction and culture improvement of lowland rice. 53. Developmental differences of young panicles in different maturing rice varieties as affected by the time of cultivation and a method for identifying the developmental stages.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 201–4, bibl. 13, English summary. [Nat. Inst. Agric. Sci.]

1709 Sarkar, K. K. **Photoperiodic behaviour of a wild variety of rice.** *Sci. and Cult.* 1960, **25**, No. 9, 540–1, bibl. 2. [Arambagh Coll., Arambagh, W. Bengal]

Oryza sativa var. *fatua*, a natural cross between *O. perennis* and *O. sativa*, is found in low-lying areas of Bengal and Orissa. Its morphological peculiarities are described. Short day (8-hr period from 10.0 a.m. to 4.0 p.m.) brought forward the date of flowering and reduced the period required for maturity (given as ear emergence to fruit setting) from a range of 38–49 days (according to sowing date) in the control plants to 15–20 days in short-day plants. This reaction to photoperiod has not so far been observed in cultivated varieties. Low temperature reduced the effect of short day as regards duration of flowering.—D.B.

1710 Yoshida, S. and others. **Role of silicon in rice nutrition.** *Soil Pl. Fd* 1959, **5**, No. 3, 127–33, bibl. 20, illus. [Nat. Inst. Agric. Sci., Tokyo, Japan]

Rice was grown in culture solutions with and without silica during 2 years ; plant growth, yields, transpiration, Si content and mineral composition of plants were determined. Si was not essential for growth in length or for tiller formation, but was essential for growth during the reproductive stage and for good grain yields. In the absence of Si the content of other mineral elements in the plant, especially Mn, was higher. The accumulation of mineral compounds was thought to be related to the high transpiration rate of Si-deficient plants. Such plants absorbed large quantities of water and were susceptible to attack by fungi and insects.—D.B.

1711 Chakraborty, S. P. and Sen Gupta, S. P. **Fixation of nitrogen by the rice plant.** *Nature, Lond.* 1959, **184**, No. 4704, 2033–4, bibl. 8. [West Bengal State Coll. Agric., Nadia, India]

The authors' culture-solution experiments with the Aman variety of *Oryza sativa* indicate that the plant is able to synthesize elementary N under conditions of N starvation, and that this ability decreases with increasing age of the rice plant.—M.H.

1712 Hasegawa, G. and others. **Studies on leaf analysis. 9. Seasonal changes of mineral elements in successive leaves, internodes and ear on the main culm of rice plant, and their accumulation and translocation. (Subpart 1)** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 169–74, bibl. 13, English summary. [Hyogo Univ. Agric.]

1713 Yamada, I. and Hasegawa, H. **On the artificial germination of pollen of rice plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 157–9, bibl. 9, English summary. [Kyoto Univ.]

The percentage germination of pollen grains taken from strong spikelets of rice plants was markedly affected by temperature of the soil water. The best temperature was 28°C ; 23°C and 33°C were unfavourable. F. Eng s.—D.B.

1714 Yates, F. and others. **An exploratory analysis of a large set of 3 × 3 × 3**

fertilizer trials in India. *Emp. J. exp. Agric.* 1959, **27**, No. 108, 263–75, bibl. 3. [Rothamsted Exp. Sta., Harpenden and Dep. Agric., Bihar, India]

The Rothamsted electronic computor was used to make a combined analysis of 238 single-replicate factorial trials on rice carried out in Bihar, India in 1956–7. Details are given of the procedure for analysis. Good responses to the application of 20 lb N and 25 lb P/ac were obtained ; responses to applications of K were relatively smaller and there was little interaction between N, P and K. F. s.—s.m.j.

1715 Yamada, N. **The nature of fertilizer response in japonica and indica rice varieties.** *Internat. Rice Comm. News Lett.* 1959, **8**, No. 4, 14–19. [Ceylon Dep. Agric.]

In a trial with the japonica var. Norin-1, Kanan-8 and Taichung-65 and the indica var. Murungakayan 302 and H-4, all varieties, with the exception of Murungakayan 302, showed a high response in yield to the application of fertilizers. The indica varieties are capable of producing more dry matter than the japonica varieties, but have a lower ratio of grain to total dry matter and a higher percentage of sterile grains. Murungakayan 302 is suitable for broadcasting on unmanured or moderately fertile soils, while H-4 yields well when transplanted at a wide spacing and when high rates of fertilizers are applied. F. s.—e.b.o.

1716 Director of Agriculture, Fisheries and Forestry, Hong Kong. **Paddy investigations.** *Rep. Dep. Agric. Fish. For. Hong Kong* 1958–9, 28–32. [Received May, 1960]

Ten rice varieties were tested under the following fertilizer treatments : 0, 30, 60 or 90 lb N as ammonium sulphate/ac, with 30 lb P_2O_5 as superphosphate/ac and 15 lb K_2O as muriate of potash/ac added to all plots. At the 1st crop in 1958, all 10 varieties showed marked responses to N up to 90 lb/ac. Kam Bau Ngan gave the highest yield and Chat Tam Chung the greatest % yield increase. At the 2nd crop in 1958, application of 60 lb N/ac appeared to be beneficial. Larger applications were sometimes harmful. Sam Sin Kuk was the highest-yielding variety. The results of fertilizer trials on typical rice soils in 6 districts are summarized.—a.m.h.

1717 Nozaki, M. and others. **Fundamental studies on yield-forecast in rice plant. 4. On the relationship between the increase of top-dry-weight and its related factors during the ripening period.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **25**, No. 2, 182–3, bibl. 2, English summary. [Mie. Agric. Statistics and Survey Office]

It appears possible to forecast dry-matter production by determining, at the beginning of ripening, the total N content in all leaf blades per unit field area.—F. Eng. s.—d.b.

1718 Tsuno, Y. and others. **Studies on yield-forecast in main crops. 5. The effect of light-receiving condition and nitrogen content in a plant on the dry matter production of rice plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 188–90, bibl. 10, English summary. [Hyogo Agric. Statistics and Survey Office]

1719 Yamada, N. **A note on the analysis of the yield potential in the indica hybrid, H-4.** *Internat. Rice Comm. News Lett.* 1959, **8**, No. 4, 20–3. [Ceylon Dep. Agric.]

1720 Ong, S. and Chandrapuang, P. **Some problems on managing rice farms in Nakorn Pathom Province, Thailand.** *Internat. Rice Comm. News Lett.* 1959, **8**, No. 3, 16–22.

An analysis of the data collected from 34 farms showed that under present conditions the optimal size of a rice farm in Nakorn Pathom is 30 rai [1 rai = 0·16 ha]. To raise the standard of living of the farmers the present mono-culture should be replaced by a diversified type of farming. —e.b.o.

1721 Dufournet, R. and others. Travaux et essais sur riz à la Station Agronomique du Lac Alaotra 1957–1958. [**Work and trials on rice at the Agronomic Station at Lake Alaotra in 1957-8.**] *Bull. 3 Inst. Rech. agron. Madagascar* 1959, 6–21, illus.

In 1958, rice production in Madagascar was estimated at 1,200,000 metric tons of paddy, most of which was of inferior quality. Data are given of the climate at Lake Alaotra Station where work is in progress to obtain improved rice varieties. Observations were made on the vegetative cycle of the varieties Vary Lava and Makalioka, which is influenced by the date of transplanting. An account is given of varietal and manurial trials. In irrigation trials, the highest yields were obtained by continuous irrigation from transplanting to maturity. In trials to study the effect of shading on Makalioka 823, the non-shaded control yielded best.—e.b.o.

GENERAL

1722† Idia. Avena, cebada y centeno. Informe preparado por el Centro Regional Pampeano. [**Oats, barley and rye (in Argentina). Report prepared by the Centro Regional Pampeano.**] *Idia* 1959, No. 135, 1–48, maps.

Oats, rye and barley, the most important forage cereals in Argentina, were sown in 1956–7 on 5,050,100 ha (rye on 2,807,400 ha, oats on 1,887,700 ha and forage barley on 355,000 ha).

Of the total area, 54% was exclusively grazed (winter grazing) ; the remainder was grazed and also used for grain production. Almost all the oats grown are *Avena byzantina*. Malting barley was sown on 199,000 ha. Information is given on regions of cultivation, crop areas, yields and varieties.—E.B.O.

1723 Jalkanen, P. I. Viljalajien riveitäisyysja klvömääräkokeista hameen koeasemalla. **Row distance and seed rate experiments with different spring cereals at Hame Agricultural Experiment Station.** *Maatal. ja Koetoim.* 1960, **14**, 45–50, English summary. [Hame Agric. Exp. Sta., Pälkäne, Finland]

Row spacings of 12·5 cm and 17·5 cm and seed rates of 200 and 160 kg per ha (for barley and oats) and of 300 and 240 kg per ha (for spring wheat) were tested in experiments made from 1955 to 1959. The soil was silty, fine sand. On average, the smaller distance between the rows and the heavier seed rate were most advantageous. Only in particularly favourable seasons could equally good results be obtained from wider row spacing and lower seed rates. F. Eng. s.—G.M.R.

1724 Brady, J. J. **Cereal variety trials at the Department's farms in 1956.** *J. Dep. Agric. Republ. Ire.* 1957–8, **54**, 169–80. [Received Jan., 1960]

The spring wheat varieties Atson, Peko, Karn II, Koga II and Svenno were tested at 4 centres against Atle as control variety. Svenno was the earliest variety and Peko the latest. All yielded significantly more than Atle, and Koga II and Peko yielded significantly more than Atson, Svenno and Karn II. Over the period 1954–6, the relative yields of Atle, Atson and Koga II were 100, 106 and 107, respectively. Koga II was somewhat more resistant to lodging than Atle but more susceptible to black stem rust [*Puccinia graminis*]. Both Koga II and Atson were more susceptible to sprouting in the ear than Atle. In trials with oats, Bamboo II and Glasnevin Triumph yielded significantly less than Rex, Sun II and 16004. In a 2nd trial, Blenda significantly outyielded Pendek at 4 centres. It had longer straw, but was more resistant to lodging than Pendek. In 1954–6 the relative yields of Glasnevin Triumph and Rex were 100 and 103 and those of Blenda and Pendek 100 and 101, respectively. Four Spratt Archer × Kenia selections of barley (S.A.K. 22/11, 17/8, 33 and 115) yielded significantly more than Herta and Ingrid. In 1954–6 the respective relative yields of Herta, S.A.K. 33 and S.A.K. 17/8 were 100, 105 and 102. S.A.K. 17/8 was somewhat later maturing than Herta and S.A.K. 33. Herta was more resistant to lodging than the other varieties, but more susceptible to loose smut [*Ustilago tritici*]. —A.M.H.

1725 Journal of the Department of Agriculture, South Australia. **Cereal variety trials.** *J. Dep. Agric. S. Aust.* 1960, **63**, No. 6, 220–31, illus.

A common practice in South Australia is to grow oats for early winter grazing before taking a crop of grain. Oat varieties suitable for this purpose were tested at the Kybybolite Research Centre in 1958. Avon yielded 96 bu grain/ac when ungrazed and 58 bu grain and 2064 lb dry matter/ac if grazed twice before taking the grain crop. Of the newer wheat varieties under test, Wongoondy, a semi-hard wheat, showed promise on light soils. The South Australian variety Claymore also showed promise. At Turretfield and Urania the effect of various fertility levels on different varieties of barley is being investigated. In a sowing-rate trial with barley at Turretfield, in which rates of 32–80 lb seed/ac were used, the highest rate resulted in a slight reduction in grain quality and the lowest rate in a slight loss in yield. In a 3-yr comparison of pre-harvest windrowing and rolling on barley crops, both methods gave protection against yield losses caused by wind and could be carried out 12 days before full maturity without reducing grain quality. Light to moderate rains falling on windrowed or rolled crops caused no loss of yield or quality.—S.M.J.

1726 Roberts, E. H. **The viability of cereal seed in relation to temperature and moisture.** *Ann. Bot., Lond.* 1960, **24**, No. 93, 12–31, bibl. 33. [West African Rice Res. Sta., Rokupr, Sierra Leone]

Critical examination of previous work on the viability of cereal seeds shows that there is a simple mathematical relationship between temperature, moisture content, and period of viability. There is evidence that this relationship is similar for wheat, barley, and oats. If the moisture content and temperature of the seed are known it is possible to predict the expected life of the seed ; or, alternatively, it is possible to predict various combinations of storage conditions necessary to achieve a required period of viability. These results are discussed in relation to current theories concerned with factors which cause loss of viability in seeds. F. s.—M.H.

1727† Springensguth, W. Untersuchungen über die Anwendung von Kalkstickstoff und Kalidüngemitteln zur Bekämpfung des Ackerfuchsschwanzes (*Alopecurus agrestis* L.). [**The use of cyanamide and potash manures for the control of slender fox-tail** (*A. agrestis*).] *Z. Acker- u. PflBau* 1960, **110**, No. 1, 69–81, bibl. 2, English summary. [PflSchAnst, Landwirtschaftskammer Westfalen-Lippe, W. Germany]

A. agrestis [*A. myosuroides*], which infests cereal fields, is sensitive to the herbicidal action of calcium

cyanamide until its seedlings reach the 2-leaf stage. The best treatment consisted of 200 kg calcium cyanamide per ha applied to cereal fields in autumn and spring, the latter application being reinforced by 400 kg 40% potassium salt (sylvine or kainite). These manures should be applied when the plants are dry but the ground moist and not during spells of ground frost.—D.B.

1728 Bachthaler, G. Feldversuche zur chemischen Bekämpfung der Echten Kamille (*Matricaria chamomilla*) in Wintergetreide. [**Field trials on the chemical control of wild chamomile in winter cereals.**] *Prakt. Bl. PflBau* 1959, **54**, No. 4, 117–25.

In the intensively cultivated arable area of Lower Bavaria there is an annually increasing mass infestation of *Matricaria chamomilla* in winter cereal fields. It comprises about 70% of the weed population. Raphatox (DNC) sprayed on to fields of winter wheat and winter barley in autumn and spring at 4 kg in 800 l water/ha killed almost 100% of *M. chamomilla*. It also killed *Lamium purpureum*. Pesco (MCPA + trichlorbenzoic acid) at 5·5 l/ha was also satisfactory. After a slight initial set-back, the cereals recovered, and grain yields were approximately the same as in the untreated plots. —D.B.

1729 Aufhammer, G. Erhaltung der Keimfähigkeit und Ertragsleistung. [**Longevity and productivity of seed stored for long periods.**] *Bayer. landw. Jahrb.* 1959, **36**, Sonderheft 2, 80–3, bibl. 1, illus.

A brief report is given on the characteristics and yields of the progeny of 15 barley seeds and 8 oat seeds found after being stored for 125 years (see *Fld Crop Abstr.* 11 : 589). The seeds were grown under the same conditions as present-day varieties of oats (NOS Weisshafer) and barley (Ackermann's Donaria). Compared with these, oat plants grown from seed harvested in 1830 were taller, were less resistant to lodging and to frit fly and had looser panicles ; grain yields were 30–50% lower. Barley from the 1830 seed had smaller ears and coarser husks ; the discrepancy in grain yield was not so great as with oats. The progeny of the separate lines of plants exhibited marked differences.—D.B.

1730 Pohjanheimo, O. and Kyläkäidännästä. [**Sprouting in grain.**] *Maatal. ja Koetoim.* 1960, **14**, 63–82, illus., German summary. [Agric. Res. Sta., Jokioinen, Finland]

A very considerable reduction in the value of Finnish cereal crops has been caused by the sprouting of grain in the ear in certain years. The risk of this is enhanced in Finland, where early harvesting by the combine is of special importance. Some objectives for the breeder are listed, wherein marked dormancy, rarer in early than in late varieties, is of less importance than length of straw, strength of stand, bending of the stalk and ears, and composition of ears and spikelets. Germination capacity and tendency to sprout are shown in diagrams for several cereal varieties which were cut at different times and then stored for different periods. F. Ger. s.—G.M.R.

1731 Paatela, J. and Suomela, H. Kevätviljojen Viljelyvarmuudesta. **On the certainty of obtaining a crop of spring cereals in Finland.** *Maatal. ja Koetoim.* 1960, **14**, 51–62, English summary. [Dep. Plant Husbandry, Univ. Helsinki]

In order to determine how early it is necessary for spring cereal varieties to ripen so as to obtain a crop, a study was made of experimental material obtained from varietal trials conducted over 25 years in southern Finland (Tammisto, 60° 17′ N.) and central Finland (Maaninka, 63° 9′ N.). Ripening was slower at Maaninka than at Tammisto, where the average daily temperatures during the growing season were higher. The length of the growing period varied considerably from year to year and the coefficient of variation of the growing period was clearly greater than that of the temperature summation necessary for ripening. On the basis that different cereal varieties require a fairly constant temperature summation for ripening, the growth period needed in various parts of Finland for the ripening of late (Diamond, Timantti) and a moderately early variety of spring wheat (Apu) and of an early variety of barley (Tammi) is shown. Diamond grown in southern Finland was as reliable as Apu grown about 200 km further north, and in turn Apu grown in central Finland was as certain as Tammi barley grown about 200 km still further north. The growing period should be approximately 5 days shorter for each 100 km further north. F. Eng. s.—G.M.R.

1732 Tokimasa, F. and Suetomi, M. **Studies on the harm by shading on wheat and barley. 7. A consideration of the diurnal variation of the NH_4-N absorption, especially in relation to the sunshine. 8. The effect which shading at different periods exerts on the growth and yield of wheat and barley.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 219–21, bibl. 6, English summary. [Yamaguchi Univ.]

The maximum absorption of NH_4-N occurred after 18–22 hours of sunshine. Shading of wheat and barley at different growth periods reduced yields to different extents. If shaded during the appearance of 'successful' panicles, the number of panicles decreased, ripening was hindered and grain yield reduced. There was a period [not stated] when shading caused no reduction in yield, and another

period when shade could increase yields by checking the growth of 'unsuccessful' panicles. F. Eng. s. —D.B.

1733 Coïc, Y. Sur la teneur en manganèse des céréales en fonction de la déficience des sols en manganèse assimilable. [**The content of Mn in cereals in relation to the deficiency of assimilable Mn in soils.**] *C.R. Acad. Agric. Fr.* 1960, **46,** No. 6, 287–91, bibl. 4.

1734 Weber, Anna. Magnesiummangel. 2. Forsøg og undersøgelser på friland og i store urtepotter 1953–57. [**Magnesium deficiency. 2. Field and pot trials.**] *Tidsskr. Planteavl* 1959, **63,** No. 3, 394–447, illus., English summary.

In a series of experiments with test-plants which included wheat, rye, oats and barley, Mg-deficiency symptoms appeared to be more severe in summer under conditions of strong sunlight, than in the autumn, at which time symptoms practically disappeared. The addition of Mg as $MgSO_4$ to oats and barley grown in pots in black, sandy, acid soil from Jutland, deficient in Mg, resulted in a 100% increase in green weight. F. s.—S.M.J.

1735 Agronômico, Campinas. Silos metálicos en clima tropical. [**Metal silos in a tropical climate.**] *Agronômico, Campinas* 1959, **11,** No. 9–10, 11–18.

The problem of storing cereal grain in tropical regions is reviewed. It is concluded that in north and north-east Brazil, the only effective method is in silos — those above ground being more suitable than those below. The silos can be made of concrete, or of metal with single or double walls ; the advantage of using silos of concrete, or with double metal walls, over silos with single metal walls, is a little greater in the north-east than in the north. In the north, where possible, it is preferable to use hermetically sealed metal silos and the grain must be dried before storage. This is less important in the north-east. Pest control is essential in both regions.—E.B.O.

1736 FAO. **Report of the fourth session of the FAO Group on Grains to the Committee on Commodity Problems.** *Publ. CCP59/21 FAO* 1959, pp. 32.

The grain situation in the world is reviewed. The production of grain crops increased considerably in 1958–9.—E.B.O.

LEGUMES

COWPEAS

1737 Chant, S. R. **The effect of infection with tobacco-mosaic and cowpea yellow-mosaic viruses on the growth rate and yield of cowpea in Nigeria.** *Emp. J. exp. Agric.* 1960, **28,** No. 110, 114–20, bibl. 9. [Fed. Dep. agric. Res., Moor Plantation, Ibadan, Nigeria]

The effect of infection by the cowpea strain of tobacco-mosaic virus, cowpea yellow-mosaic virus, and a mixture of the 2 viruses on the growth rate, development and yield of cowpeas (*Vigna unguiculata*) is described. Cowpea yellow-mosaic virus reduced the leaf area and the number of flowers and pods produced. Tobacco-mosaic was less severe but caused some reduction in yield. Late infections had less effect on yield than early ones.—S.M.J.

1738 Ueda, H. and Oyama, K. **Studies on nodule bacteria of leguminous plants in a sand dune. 1. Some conditions on the nodule formation of *Vigna* plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28,** No. 2, 247–9, English summary. [Tottori Univ.]

Fertilizers and irrigation significantly increased nodulation. F. Eng. s.—D.B.

SOYABEANS

See also Abs. 1647, 1690, 1921, 1923.

1739 Pendleton, J. W. and others. **For best yields grow soybeans in narrow rows.** *Ill. Res.* 1960, **2,** No. 1, 3–4, illus.

Soyabeans of 4 varieties were sown in rows 8, 24, 32 or 40 in. apart at 100, 75, 62·5 and 50 bu seed/ac, respectively, at 1 location in 1958 and at 3 locations in 1959. In all trials, yields from 24-in. rows were greatest. Severe lodging occurred in some plots sown in 8-in. rows, and weed control was considerably more difficult than at the wider row-spacings.—R.B.

1740 Lehman, W. F. and Lambert, J. W. **Effects of spacing of soybean plants between and within rows on yield and its components.** *Agron. J.* 1960, **52,** No. 2, 84–6, bibl. 11. [Univ. Minnesota, St. Paul]

Blackhawk and Mandarin (Ottawa) soyabeans were grown in 1953 at St. Paul and Waseca, Minnesota, in rows 20 or 40 in. apart with 4, 8, 16 or 24 plants per foot of row. Dry autumn conditions and severe lodging occurred at St. Paul. Seed yields at Waseca, but not at St. Paul, were greater at the narrower than at the wider row-spacing. Blackhawk gave higher yields than Mandarin at 4 plants per foot of row and lower yields at the other 3 spacings. The weight per seed (both varieties) and the number of seeds per pod (Blackhawk only) were greater at the wider than at the narrower row-spacing at St. Paul, while weight per seed (Mandarin only) was greater at the narrower row-spacing at Waseca.

Weight per seed increased with increasing spacing within the row at St. Paul only. At both locations, the number of seeds per pod decreased as the spacing between plants in the row decreased ; at St. Paul, the decrease was more rapid in Blackhawk than in Mandarin. The number of seeds and pods produced per plant was less in 20-in. than in 40-in. rows, and decreased as the spacing within the row decreased. Soyabean plants were more branched when spaced widely. Where 4 plants were grown per foot of row, the number of pods and seeds produced on branches was as great as the number produced on the main stem, whereas at the 2 closest spacings very few pods and seeds were produced on branches.—R.B.

1741 Runge, E. C. A. and Odell, R. T. **The relation between precipitation, temperature, and the yield of soybeans on the Agronomy South Farm, Urbana, Illinois.** *Agron. J.* 1960, **52**, No. 5, 245–7, bibl. 5. [Illinois Agric. Exp. Sta., Urbana]

Examination of soyabean yield data for 1909–57 showed that 68% of the variation in yield could be accounted for by variations in rainfall and maximum temperature between 25 June and the end of the growing season, 20 Sept. Soyabean yields were increased where above-average precipitation occurred during July or between mid-Aug. and mid-Sept. Above-average precipitation at other times during the growing season tended to reduce yields. Maximum temperatures between 6 July and 31 Aug. were too high for optimum yields.—R.B.

1742 Boletín de Divulgación, Bogotá. La soya. [**Soyabeans.**] *Bol. Divulg., Bogotá* 1959, No. 18–19, 14–16, illus.

It is thought that soyabeans could become an important crop in the cotton area of Colombia, especially in the Cauca Valley, where they could be introduced into the crop rotations. A summary is given of preliminary results from varietal trials. The variety Pelícano showed good adaptation and yielded 1529 kg of seed per ha. Wabash is considered suitable for green manure only and Otootan for fodder.—E.B.O.

1743 Mitrović, A. Prilog proučavanju bioloških osobina i proizvodnih vrednosti soje na području Južnog Banata. [**The biological characters and productivity of soyabeans in South Banat.**] *Arhiv polj. nauke* 1960, **13**, No. 39, 34–45, bibl. 8, English summary. [Inst. Agric. Res., Zemun Polje, Yugoslavia]

Yields from the best varieties range from 2228 to 2503 kg/ha. The duration of the growth phases under conditions in South Banat [approx. 45°N. 21°E.] depends primarily on the character of the varieties and to a less extent on temperature and moisture. F. Eng. s.—M.H.

1744 Howell, R. W. and others. **Response of soybeans to seed-treatment with gibberellin under simulated commercial conditions.** *Agron. J.* 1960, **52**, No. 3, 144–6, bibl. 14, illus. [U.S. Regional Soybean Lab., Urbana, Illinois ; Illinois, Minnesota, Mississippi, N. Carolina and S. Carolina Agric. Exp. Stas, and Univ. Manitoba]

Soyabeans of 9 varieties were treated with 0, 2 or 8 g K gibberellate in 1 pint water/bu seed and sown on a field scale at 6 locations and in smaller hand-harvested plots at 3 locations. Treatment caused increased lodging at 4 locations, reductions in crop stand at all locations, reduced yields in all experiments except one, and increased plant height by up to 9 in. Maturation was delayed by 7 days at Winnipeg, advanced by 3 days at Urbana, and was unaffected at other locations. GA at 8 g/bu reduced the oil content and increased the protein content of the seed at Winnipeg, but had little effect on these characteristics at the other locations. F. s.—R.B.

GROUNDNUTS

See also Abs. 1647.

1745 Shear, G. M. and Miller, L. I. **Influence of plant spacing of the Jumbo Runner peanut on fruit development, yield, and border effect.** *Agron. J.* 1960, **52**, No. 3, 125–7, bibl. 13, illus. [Virginia Agric. Exp. Sta., Blacksburg]

Jumbo Runner groundnuts, var. Holland, were grown in 1954 spaced 8 × 8 in., 12 × 12 in. or 16 × 16 in., and in 1955 spaced 6 × 6 in., 8 × 8 in., 10 × 10 in. or 12 × 12 in., as 4-plant plots plus a 1-row border. In 1956 the plants were grown with a 3-row border and spaced 6× 6 in., 9 × 9 in. or 12 × 12 in. Results showed that border effects were eliminated where a 3-row border was used. In 1956, yields from the second border row were 32·8% higher than those from the centre plot at the 12-in. spacing, 33·4% higher at the 9-in. spacing and 54·5% higher at the 6-in. spacing. Fruit development was less rapid at the 6-in. spacing than at wider spacings. Yields of pods were greatest at the 6-in. spacing (5969 lb/ac).—R.B.

1746 Dufournet, R. and others. Travaux sur l'arachide à Madagascar. [**Work on groundnuts in Madagascar.**] *Bull. 3 Inst. Rech. agron. Madagascar* 1959, 34–59, bibl. 12.

Information is given on climate and soils, and on varieties, yields, rotations, manuring and spacing of groundnuts, in the Sihanaka region, Madagascar. The production is 2800–3000 metric tons,

with an average yield of 950 kg unshelled nuts per ha. It is thought that from the same area the production could be raised by 50% and quality could be improved by manuring, early sowing and weeding. At present rice is transplanted in December which is the best month for sowing groundnuts. It is recommended that rice should be transplanted during 1 Nov. – 10 Dec. and that groundnuts should be sown during 10 Dec. – 10 Jan. Results are given from varietal trials with groundnuts in various regions of Madagascar.—E.B.O.

1747 Department of Agriculture, Tanganyika. **Irrigation of field crops.** *Rep. Dep. Agric. Tanganyika 1958* 1959, 11–13.

Of 3 groundnut varieties tested at Ikowa and Mag'onyi, Natal Common gave the highest yield (1010 lb shelled nuts/ac under irrigation and 930 lb/ac without irrigation) when sown on 8 Jan. Populations and yields of irrigated groundnuts varied widely because of uneven wetting of the ridges. Irrigation of groundnuts did not enable sowing dates to be delayed beyond the end of Dec. without incurring considerable yield reductions.—S.M.J.

1748 Munro, J. M. **Mulching and ridging of crops.** *Progr. Reps Exp. Stas Cott. Gr. Corp. Nyasald Protect. 1958-9* 1960, 6, [Makanga, Nyasald]

Tie-ridged plots of groundnuts yielded 531 lb shelled nuts/ac, compared with 203 lb from flat plots, (no mulch applied). The application of a heavy straw mulch resulted in yields of 575 and 617 lb shelled nuts/ac from tie-ridged and flat plots, respectively. Mulching maize in combination with supplementary irrigation resulted in a significant yield increase [not specified].—S.M.J.

1749 Department of Agriculture, Tanganyika. **Intercropping of groundnuts.** *Rep. Dep. Agric. Tanganyika 1958* 1959, 13–14.

Higher yields were obtained at Mwanhala from groundnuts and maize intercropped than when each was grown in pure stands (193 and 413 lb/ac, respectively, for groundnuts and maize intercropped (1 ac) compared with 118 and 287 lb/ac when grown in 2 pure stands, each of 0·5 ac). When groundnuts and sorghum were intercropped groundnut yields were 213 compared with 99 lb/ac from pure stands of groundnuts, but sorghum yields were similar (93 and 91 lb/ac). It was calculated that 1·34 ac of pure stand would be required to give the same yield as 1 ac of intercrop for groundnuts and maize, and 1·52 ac for groundnuts and sorghum. [See also *Fld Crop Abstr.* 12 : 1584.]—S.M.J.

1750 Sangave, R. A. and others. **Groundnut improvement in the Bombay Deccan.** *Indian Oilseeds J.* 1960, **4**, No. 1, 23–5, bibl. 3. [Dep. Agric., Bombay]

In 3-year farm trials the improved variety Karad 4-11 gave 13·8 – 20·5% higher yields of pods, 1·9% greater shelling out-turn and 3·4% higher oil content than local varieties. F. S.—D.B.

1751 Kirinde, S. T. W. **Some effects of IPC and CIPC on groundnuts.** *Trop. Agriculturist* 1959, **115**, No. 1, 7–13. [Dry Zone Res. Sta., Maha Illuppallama, Ceylon]

In weed control studies, groundnuts grown in pots were dusted at various stages with IPC and CIPC at 1 lb active material per acre. Common responses were death of seedlings, stunting, chlorosis and curling of leaflets. Resistance to the effect of the chemicals increased with age, but whereas CIPC depressed the final yield in terms of number and weight of nuts when applied at all stages, IPC depressed yield, in comparison with that of the untreated controls, only when applied at, or earlier than, the 4-leaf stage. F. S.—E.B.O.

1752 George, M. R. and others. **Protection of seed groundnuts.** *Rep. W. Afr. stored Prod. Res. Inst. 1958* Lagos [n.d.], 46–7.

At Dambarta, N. Nigeria, in Jan. 1958, the effect was investigated of dusting cleaned and uncleaned undecorticated groundnuts with 0·5% γ-BHC at a rate of 5·5 ppm before storing the seed in 6 'rumbus' made of matting and left open to the sky. By April 1958 the original infestation of the groundnut seed by *Tribolium castaneum*, *Oryzaephilus mercator*, *Ephestia cautella*, *Plodia interpunctella* and *Corcyra cephalonica* had been completely killed by treatment.—S.M.J.

1753 Singh, G. and Dalal, J. L. **Certain observations on single and multi-seeded pods in groundnut crop.** *Indian Oilseeds J.* 1960, **4**, No. 1, 20–2, illus. [Dep. Agric., Punjab]

1754 Rao, S. D. T. and Murti, K. S. **Compositional studies of Indian groundnuts : 2. South Indian groundnuts.** *Indian Oilseeds J.* 1960, **4**, No. 1, 4–14, bibl. 12. [Oil Techn. Inst., Anantapur]

The paper consists mainly of tabulated data on the chemical and physical properties of 110 samples of *Arachis hypogaea*, harvested during 1954–7, from Andhra and Madras States. The samples consisted of several varieties of the bunch- and spreading-type. From data in published literature it was shown that the chemical and physical properties of groundnuts from S. India compared favourably with those of groundnuts produced in other parts of the world.—D.B.

1755 Rao, M. B. and Raman, V. S. **Studies in the genus *Arachis* : 8. Note on classi-**

fication of groundnuts. *Indian Oilseeds J.* 1960, **4**, No. 1, 15–16, bibl. 2. [Agric. Res. Inst., Coimbatore]

1756 Tetenyi, P. Les ' taxons ' infraspécifiques de l'arachide (*Arachis hypogaea* L.). [**The infraspecific ' taxons ' of groundnuts** (*A. hypogaea*).] *Oléagineux* 1960, **15**, No. 6, 471–4, bibl. 22, illus. [Inst. Rech. Pl. Méd. Budapest, Hungary]

The new system of classification of groundnuts presented includes 14 ' taxons ' which are units of classification within the species. The taxons do not represent hybrids but have been defined following observations on characters common to 140 varieties. They consist of 12 ' provarietas', which include the cultivated groundnuts, and of 2 ' varietas ' or wild groundnuts.—E.B.O.

1757 Piggott, C. J. **The effect of fertilizers on the yield and quality of groundnuts in Sierra Leone.** *Emp. J. exp. Agric.* 1960, **28**, No. 109, 59–64, bibl. 14. [Dep. Agric., Sierra Leone]

The only fertilizers at present necessary for improving the yield of groundnuts in Sierra Leone are those containing K, Mg and Ca, of which K and Mg are beneficial to the plant as a whole, whilst Ca improves shelling percentages. Increases in yield obtained with superphosphate were due to its Ca content. F. s.—S.M.J.

PEAS

1758 Salter, P. J. **Irrigation of peas.** *Rep. nat. veg. Res. Sta., Warwick 1959* Wellesbourne, 1960, **10**, 31.

Peas which were sown in soil at field capacity on 25 May 1959 received 4 different irrigation treatments (not specified). Increases in the amount of water applied between the times of sowing and flowering increased haulm weight, but did not increase the yield of shelled peas. Irrespective of watering treatment prior to flowering, 0·5 in. water applied when the pods began to swell increased the yield of shelled peas by 15%, but slightly delayed maturity.—S.M.J.

1759 Danielson, C. E. **Sugar and water in ripening peas** (***Pisum sativum* L.**). *Physiol. Plant.* 1960, **13**, No. 2, 342–7, bibl. 7. [Findus Res. Lab., Bjuv, Sweden]

Whole seeds, embryos and integuments of *Pisum sativum* were analysed 30 min after harvest. During the early stages of ripening after harvest there was a linear relationship between sugar and water content. Most of the apparently sugar-free water was situated in the integuments and the remainder in the endosperm. The total sugar content was approx. 3·9% and was concentrated mainly in the embryo. Before natural dehydration of the seeds during maturation the total sugar-content increased at the same time as water content. [See also *Fld Crop Abstr.* 13 : 1239.]—S.M.J.

1760 Highkin, H. R. **Effect of vernalization on heat resistance in two varieties of peas.** *Pl. Physiol.* 1959, **34**, No. 6, 643–4, bibl. 3. [California Inst. Technol., Pasadena]

Seed of peas var. Unica and L5 were grown in darkness at 4°C for 25 days, or at 23°C for 5 days, and transferred simultaneously at the same stage of growth to 16-hr days at 26°C. Vernalized plants of both varieties showed considerably less heat necrosis than unvernalized plants. The first flowering node of Unica was significantly lower on vernalized than on unvernalized plants when grown at day temperatures of 20°C and night temperatures of 14°C, but not when grown at a constant 26°C. Vernalization had no effect on the flowering response of L5 at either temperature.—R.B.

1761 Lawrence, J. M. and others. **Nitrogen mobilization in pea seedlings.** *Pl. Physiol.* 1959, **34**, No. 6, 668–74, bibl. 25. [Washington Agric. Exp. Sta., Pullman]

Peas, var. Unica, were grown in vermiculite at 18°C for 1, 3 or 5 days. On a dry-matter basis, the percentage of non-protein N in the cotyledons increased during the first 3 days and then decreased, while that in the root-shoot axis increased slowly and then rapidly. N was apparently mobilized by breakdown of reserves in the cotyledons, followed by transport and resynthesis. About 17–50% of free amino-N present in the seedlings was in the form of amides. Root and shoot tips contained much protein, while comparatively high concentrations of non-protein N were present in other portions of the root and shoot. F. s.—R.B.

1762 Nonnecke, I. L. **The precision of field experiments with vegetable crops as influenced by plot and block size and shape. 2. Canning peas.** *Canad. J. Pl. Sci.* 1960, **40**, No. 2, 396–404, bibl. 5, illus. [Canada Dep. Agric. Res. Sta., Lethbridge, Alberta]

Peas were sown at 240 lb seed/ac in plots made up of numbers of basic units 10 ft long and 5 ft wide and were grown under irrigation. In yield tests, lengthening the plots reduced variability regardless of plot shape. The optimum plot size for yield studies was that of the basic unit. Yields from such a plot, however, were inadequate for studying crop quality ; the use of longer plots or bulked samples from replicates was recommended.—R.B.

BEANS

1763 Klingmüller, W. and Lane, G. R. **Damaging effect of drying on *Vicia***

faba **seeds.** *Nature, Lond.* 1960, **185,** No. 4714, 699–70, bibl. 10. [Bot. Dep., Univ. Southampton]

In an earlier paper (*Naturforsch.* 1959, 14(b) p. 268) it was reported that drying the seeds of *V. faba* over calcium chloride at 20°C for 14 days reduces germination capacity by 60% and retards growth of the root and shoot. The work has now been extended to include study of the effect of storing the beans in desiccators for periods up to 4 weeks at 20 ± 0·5°C over certain drying reagents. There is evidence that germination capacity is progressively reduced as the beans are dried, and that the beans cannot be dried much below their normal water content without injury. The implication of the results for radiobiological work on dry seeds is indicated.—M.H.

1764 Moffatt, J. R. and Hill, M. J. **The use of simazine to control weeds in field beans and potatoes.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden 1960, 177–80.

Tick beans [*Vicia faba* var. *minor*] and potatoes, each grown at Rothamsted and Woburn, were treated with 0·5, 1 and 1·5 lb simazin/ac, 1 lb a.i. atrazine/ac, or were untreated. By June at Rothamsted, simazin at 0·5 lb/ac had almost completely eliminated *Chenopodium album, Poa annua, Stellaria media, Polygonum convolvulus* and *Alopecurus myosuroides* from the tick beans. At Woburn, where the initial weed infestation was higher and plots received only 1·15 in. rain during the 8 weeks after spraying, herbicidal applications were less effective. The optimum applications appeared to be 0·5 lb simazin/ac at Rothamsted and 1 lb simazin/ac at Woburn. In the potato experiments at Rothamsted, all weeds except *Galium aparine* were controlled. Simazin applied at 0·5 lb/ac reduced stands of *Galium aparine*, but larger applications had little further effect. Cultivation controlled *G. aparine* more effectively than herbicides. At Woburn the combined effect of drought and weed competition resulted in 50% partly shrivelled tubers on sprayed plots but only 17% on plots where weeds were controlled by cultivations. When winter beans 4–5 in. tall were sprayed in March 1959 with simazin or atrazine, *Matricaria inodora* was controlled. Simazin applied at 0·5, 1 or 1·5 lb/ac did not affect the beans, but those treated with 1 lb atrazine/ac were stunted.—S.M.J.

1765 Moffatt, J. R. and Hill, M. J. **The effect of two plant-growth hormones on the pod set and yield of field beans.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 180–2.

In 1955 and '56, 4-CPA and α-2,4,5-TP were applied as 5 ppm sprays to spring-sown tick beans (*Vicia faba* var. *minor*) soon after the first flowers opened. Plots were either sprayed twice with a week between applications, or sprayed weekly throughout the flowering period. In 1957, a treatment in which tick beans received 3 applications of 4-CPA was superimposed on an irrigation experiment at Woburn, which also incorporated a dung treatment. In 1955, 2 applications of α-2,4,5-TP decreased yields and in 1956, 4 applications of 4-CPA increased yields of tick beans. The number of pods per plant was not appreciably affected in either year. In 1957, irrigation resulted in yields of 33·1 cwt/ac from irrigated, unsprayed plots, compared with 15·8 cwt/ac from untreated plots while the application of dung, without irrigation, increased yields only slightly. Irrigation greatly increased the number of flowers per stem, but much of the increase was in flowers formed late at the top of the plant, of which probably only a few set pods. Hormone applications resulted in an increased set of flowers on dunged plots and a decrease on irrigated plots.—S.M.J.

VOANDZEIA SUBTERRANEA

1766 Rassel, A. Le voandzou *Voandzeia subterranea* Thouars et sa culture au Kwango. [**Bambarra groundnut** (*V. subterranea*) **and its cultivation in the Kwango** (**Belgian Congo**).] *Bull. agric. Congo belge* 1960, **51,** No. 1, 1–26, bibl. 8, illus., Flemish summary. [Sta. Exp. INÉAC, Kiyaka]

Information is given on the botany, ecology and cultural requirements of Bambarra groundnut. A table gives its principal characteristics, which are compared with those of the groundnut (*Arachis hypogaea*). Bambarra groundnut is the food legume best adapted to the poor soils of south Kwango where it outyields groundnuts in most cases. Pearl millet (*Pennisetum* sp.) is the only cereal well adapted to this region.—E.B.O.

LUPINS

1767† Gladstones, J. S. **Lupin cultivation and breeding.** *J. Aust. Inst. agric. Sci.* 1960, **26,** No. 1, 19–25, bibl. 60.

The cultivation and uses of *Lupinus* spp. in N. Europe, Africa, America and Australia are reviewed.—S.M.J.

1768 Silva, G. M. and Oliveira, A. J. **Experiments on control of the pests of the yellow lupin** (*Lupinus luteus* **L.).** *Agron. lusit.* 1959, **21,** No. 1, 43–74, bibl. 10, map, Portuguese summary. [Esta. Agron. Nac., Sacavém, Portugal]

Trials to test dieldrin, BHC and chlordane for the control of pests of yellow lupin grown on the sandy soils south of the river Tagus were carried out during 5 years on about 35 experimental fields. The best results were obtained from treatment with dieldrin at 6 kg/ha which gave : (a) 80% control of *Sitona* spp. ; (b) good control of cutworms ; (c)

satisfactory control of *Hylemya cana* ; (d) residual effect for at least 2 years after treatment. For practical purposes a rate of 4 kg dieldrin/ha is sufficient. F. s.—E.B.O.

1769† Lin, C. F. **Effect of phosphorus and potash on the growth, yield and mineral composition of yellow lupine (*Lupinus luteus,* L.) in connection with their residual effects.** [Chinese] *J. agric. Assoc. China* 1959, No. 28, 24–38, bibl. 15, English summary. [Pinchin Tea Exp. Sta., Taiwan Agric. Res. Inst.]

Fertilization with P increased height of plants, number of tillers and leaves per plant, weight of tops and roots, and hay yield. Potash had the reverse effect. It depressed the absorption of Ca, an element essential for root development. The residual effect of P in the following year was equivalent to 30–40% of the original application ; the residual effect of K was lower. F. Eng. s.—D.B.

ROOT CROPS

SUGAR-BEET

See also Abs. 1830.

1770 Dunning, R. A. and Dunham, E. C. W. **Seed crops.** [**Sugar-beet.**] *Rep. Rothamsted Exp. Sta. 1959* Harpenden 1960, 193.

Buckwheat [*Fagopyron esculentum*], oil-seed flax, mustard and rape [*Brassica* spp.], Nida turnip and maize, sown between rows of sugar-beet stecklings, were only half as effective in keeping plants free from *Aphis fabae* as when they were sown in the row. All were satisfactory cover crops. Oil-seed flax suppressed steckling growth least.—S.M.J.

1771 Norfolk Agricultural Station. **Processed sugar beet seed as an aid to hand-singling.** *Rep. Norfolk agric. Sta. 1958-9* Sprowston, 1959, 9–10.

In field trials with rubbed sugar-beet seed in the 7–11/64th in. size grades, the largest grade gave the lowest proportion of singles and the smallest grade had the lowest mean germination. The 3 smallest grades gave the highest proportion of singles.—J.D.J.

1772 Decoux, L. La préparation superficielle du sol dans la culture de la betterave : choses connues et choses inconnues. [**The surface preparation of the soil in sugar-beet cultivation : things known and things unknown.**] *C.R. Acad. Agric. Fr.* 1960, **46**, No. 5, 224–47, bibl. 68. [Belgium]

The surface preparation of the soil consists in a very shallow, rapid cultivation in late winter or spring, so that sugar-beet can be sown early. Early sowing is conducive to high yields. The principle underlying this method is to carry out most of the work in autumn so that work in the spring is reduced to a minimum. This method, which has been adopted first in Belgium and recently in France, is suitable for normal soils but is unsuitable for acid soils, soils deficient in humus and those infested by weeds. The main object of this article is to indicate lines for further research.—E.B.O.

1773 Klatt, F. Die Beregnung der Zuckerrübe an Hand 8 jähriger Beregnungsversuche. [**Sprinkler irrigation for sugar-beet on the basis of 8-years' trials.**] *Z. Acker- u. PflBau* 1959, **109**, No. 4, 408–29, bibl. 24, English summary. [Inst. Acker- u. PflBau, Humboldt Univ., E. Berlin, Germany]

Experiments were carried out in an inland climate of E. Germany. Sprinkler irrigation was profitable for sugar-beet cultivation if applied from beginning of July to end of Sept. Within this period, early sprinkling encouraged leaf growth and late sprinkling favoured root growth. The best quantity at any one application is 20–30 mm, but the number of applications is determined by soil type and climate. The soil must be in an adequately moistened condition before sprinkling is done. There were varietal differences in response to sprinkling, e.g. it resulted in much higher root yields in Bernburger N and in Langensteiner E than in Kleinwanzlebener E and Kleinwanzlebener N. Sprinkler irrigation increased the total sugar yield but not always the sugar percentage. Irrigation makes potash and phosphoric acid available to the plant and is most profitable when accompanied by complete fertilizer.—D.B.

1774 Willey, L. A. **Trials of commercial varieties of sugar beet.** *Brit. Sug. Beet Rev.* 1960, **28**, No. 4, 159–61. [Nat. Inst. Agric. Bot., Cambridge]

In trials with recommended sugar-beet varieties in Great Britain in 1957–9, the British varieties Sharpe's Klein Polybeet, Sharpe's Klein E, Hilleshog N, Hilleshog E and Hilleshog Polyploid, and Klein E from W. Germany, gave the highest average yields of sugar/ac. [See also *Fld Crop Abstr.* 13 : 1255.]—E.B.O.

1775 Roussel, N. and others. Les résultats des essais comparatifs de variétés de betterave sucrière en Belgique de 1954 à 1958 et de 1955 à 1959. [**The results from comparative trials of sugar-beet varieties in Belgium in 1954-8 and 1955-9.**] *Publ. tech. Inst. belge Amélior. Better.* 1958, **26**, No. 4, 149–79, and 1959, **27**, No. 4, 177–203, illus., English and Flemish summaries.

These trials are a continuation of those reported previously. [See *Fld Crop Abstr.* 12 : 208.]—E.B.O.

1776 Miyamoto, T. and Dexter, S. T. **Acceleration of early growth of sugar beet seedlings by coating of seedballs with hydrophilic colloids and nutrients.** *Agron. J.* 1960, **52**, No. 5, 269–71, bibl. 15, illus. [Michigan Agric. Exp. Sta., East Lansing]

Seedlings grown from sugar-beet seed balls soaked briefly in colloidal solutions of keltex (an algin preparation), allowed to dry, and germinated in soil emerged more rapidly but were little larger than those from untreated seed balls. The addition of inorganic and organic nutrients to the keltex solution promoted seedling growth. Greatest acceleration in seedling growth was obtained where seed was treated with Hoagland's nutrient solution minus $Ca(NO_3)_2$ at 5 times normal strength, with the addition of 0·75% keltex, 1% sucrose, and 0·05% asparagine. Decorticated sugar-beet seed treated with 0·75% aqueous keltex and stored for 1 year gave 85% seedling emergence after 5·5 days in soil containing 9·3% water, compared with 65·2% for seed not treated with hydrophilic colloid.—R.B.

1777 Detroux, L. and Wauthy, R. Compléments à l'étude du désherbage chimique des champs de betteraves. [**Complementary study on chemical weed control in sugar-beet fields.**] *Publ. tech. Inst. belge Amélior. Better.* 1959, **27**, No. 3, 145–59, English and Flemish summaries.

The results from 2 trials in 1959 at Jauchelette, Hesbaye, Belgium, confirmed the conclusions reached in previous years [see *Fld Crop Abstr.* 13 : 1259]. In one trial the soil was cultivated 9 days before sowing, in the other the day before. The best control of weeds was obtained by treatment with sodium nitrate applied after emergence at 320 kg in 800 l of water per ha, or with an emulsifiable solution of OMU plus BIPC at 4 l in 800 l of water per ha. The latter treatment, however, reduced sugar-beet yields when the soil was cultivated the day before sowing. Treatment with PCP before emergence gave a satisfactory control of weeds and did not reduce yields.—E.B.O.

1778 Byford, W. J. **Seed treatment trials [with sugar-beet].** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 193–4.

Sixteen insecticidal and fungicidal treatments were tested in 18 areas using rubbed and graded seed which had 56% of clusters infected with *Pleospora betae.* Steeping in ethyl mercury phosphate increased seedling stands by 40%, and treatment with panogen by 24%. Dried seed sprayed with 6% v/w of a 0·2% solution of EMP gave slightly fewer seedlings than untreated. Dieldrin and γ-BHC dusted on to seed treated with EMP steep gave more seedlings/oz than EMP steep alone, but heptachlor gave fewer. Treatments containing γ-BHC gave fewer seedlings/oz of seed than those containing dieldrin or heptachlor, but a thicker final plant stand. The use of EMP steep trebled, and ceresan dust doubled, the number of seedlings produced by seed with 60% of clusters infected with *P. betae.* Panogen or a 2% organo-mercury dust with or without griseofulvin were better than ceresan, but less effective than EMP steep. Griseofulvin dust alone increased the number of seedlings by 18%. The emergence of Sharpes E seed with 9–91% of clusters infected with *P. betae* was increased by 11–163% by EMP steep.—S.M.J.

1779 Höhener, H. Erfahrungen bei mehrjährigen Versuchen zur Bekämpfung der virösen Vergilbungskrankheit der Rüben in der Schweiz. [**Experiences during long-term trials to control virus yellows in sugar-beet in Switzerland.**] *Meded. LandbHogesch. Gent* 1959, **24**, Nos. 3–4, 813–20, bibl. 6.

In trials during 1957–8, ekatin (a thiometon preparation) applied at 2 l/ha as a high-volume aqueous spray when the first *Myzus persicae* appeared in sugar-beet fields, followed by a second application of 1 l ekatin/ha 10–12 days later, gave up to 98% control of virus yellows at harvest and increased yields of roots and of sugar by up to 40%. Ekatin at 1 and 2 l/ha gave complete control of *M. persicae* for 8–13 and 16 days after spraying, respectively.—R.B.

1780 Hills, O. A. and others. **Effect of virus yellows on yield and quality of sugar beet seed.** *J. econ. Ent.* 1960, **53**, No. 1, 162–4, bibl. 3, illus. [Agric. Res. Serv. USDA]

Sugar-beet plants grown for seed in the Salt River Valley, Arizona, and suffering from virus yellows and/or curly top disease, were marked and their seed yields compared with those from healthy plants. Yields of seed and percentage germination were lower, and the percentage of seed balls less than 0·125 in. diameter was greater, in plants infected with both diseases than in healthy plants. —R.B.

1781 Van Steyvoort, L. Ce qu'il faut savoir de la lutte contre la jaunisse de la betterave. [**What must be known about the control of sugar-beet yellows.**] *Publ. Vulg. Inst. belge Amélior. Better.* 1960, No. 1, 7–12.

To reduce the incidence of sugar-beet yellows the following measures are recommended : early sowing at high plant density, about 75,000 beets/ha; treatment of the crops with one of the following systemic insecticides which control the aphid vectors of the disease : meta-iso-systox at the minimum rate of 0·4 l/ha, ekatine at 1 l/ha, rogor L 40 at 0·5–0·75 l/ha or dimécron 20 at 1 l/ha. Two treatments should be given in those

regions of Belgium where the disease is most serious (Hainault, Brabant and Flanders) while in Hesbaye and Thudinie one treatment is sufficient.—E.B.O.

1782 Heuver, M. Bestrijding van vergelingsziekte in bieten. [**Virus yellows control in beet.**] *Landb Voorl.* 1960, **17,** No. 2, 81–7, bibl. 2. [PlZiektenk. Dienst., Wageningen, Netherlands]

Plots of sugar-beet at 4 locations were sprayed at the end of May 1959 and again 14 days later with endothion at 1 kg/ha, phosphamidon at 1 l/ha, or demeton or demeton-methyl (thiol ester) at 0·5 l/ha in 800 l water/ha per application. In a more extensive trial at IJzendijke (Zeeuwsch-Vlaanderen), insecticides at the same rates were applied on (a) 26 May, (b) 26 May, 9 June and 26 June, (c) 26 June. All insecticides gave good control of *Myzus persicae* and *Aphis fabae.* Demeton and demeton-methyl gave the best control, but differences among insecticide-treated plots were not significant. In both the small-scale and the extensive trial at IJzendijke, treatments (a) and (b) delayed the occurrence and spread of virus yellows by approximately 2 weeks. Treatments (a) and (b) increased yields of sugar by 38 and 44% and yields of roots by 38 and 42%, respectively. In the other 3 trials, spraying had no effect on the development of virus yellows. In one of these trials (Boxtel, N. Brabant), yields of roots were increased by 20% and sugar yields by 23% as a result of spraying ; the differences were almost entirely due to aphid control.—R.B.

1783 Racoviţâ, A. Noi cercetări privind gomoza sfeclei de zahăr. [**New research on gummosis in sugar-beet.**] *Lucr. Inst. Cercet. Aliment.* 1959, **3,** 269–96, bibl. 51, Russian and French summaries. [Romania]

During 1953–6, study was made of (a) the role played by boron, carbonates and drought as factors in the incidence of gummosis ; and (b) the possibility of selecting a sugar-beet variety resistant to this condition on the basis of its B content. It was established that there was no correlation between the quantity of soluble B or of carbonates in the soil and the severity of gummosis incidence. The use of B fertilizer aggravated the condition and it is concluded that this element should not be used on sugar-beet in dry regions. No correlation was found between the B content of the roots and their dry-matter content ; nor between total B in the leaves, leaf morphology and gummosis attack. The absorption of soluble B by the roots is a hereditary feature, strongly influenced by the environment. There was evidence that water [soil moisture?] together with the intensity of summer sunshine are causal factors of this malady in sugar-beet. Certain cultural measures are recommended for diminishing the losses resulting from gummosis. F. Russ. s.—M.H.

1784 Cuddy, T. F. **Studies on the germination of sugar beet seed.** *Proc. Ass. off. Seed Anal. N. Amer.* 1959, **49,** No. 1, 98–102, bibl. 6. [Seed Res. Lab., Can. Dep. Agric., Ottawa, Ontario]

Germination of whole sugar-beet seed balls was greatest when seed was soaked in running water for 4 hr, followed by germination at a constant temperature of 20°C or alternating temperatures of 20 and 30°C. Germination of rubbed seed was seldom improved by presoaking in water and was greatest at 20°C. Soaking in dilute aqueous $MgSO_4$ solution instead of in water gave promising results. F. s.—R.B.

1785 Snyder, F. W. **Effect of nitrogen on yield and subsequent germinability of sugar beet seed.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10,** No. 5, 439–43, bibl. 2. [Michigan Agric. Exp. Sta., East Lansing]

Sugar-beet was grown for seed in vermiculite cultures at 2 levels of N in 1956 (0·0148 and 0·0484 M) and at 3 levels of N in 1957 (0·0136, 0·0472 and 0·0808 M). Nutrient solution was applied at 800 ml/day per pot, each of which contained 2 plants. Additional water was supplied as the plants became larger. In 1956, plants receiving the low level of N yielded significantly more seed than those receiving the high level. In 1957, plants receiving least N yielded most seed and those receiving most N least seed, but the differences were not significant. Seed harvested from plants grown at the highest level of N in 1957 showed significantly greater percentage germination after 5 days than did seed from the other 2 levels of N.—R.B.

1786 Martens, M. Observations préliminaires sur la lignification des betteraves sucrières effectuées en Belgique, au cours de l'année 1958. [**Preliminary observations on lignification of sugar-beet in Belgium in 1958.**] *Publ. tech. Inst. belge Amélior. Better.* 1958, **26,** No. 4, 181–200, illus., English and Flemish summaries.

1787 Shepherd, L. N. and others. **The sodium-potassium nutrition of sugar beets produced on organic soil.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10,** No. 7, 603–8, bibl. 3. [Michigan Agric. Exp. Sta., East Lansing]

Soil containing 85% organic matter was given 100, 200, 300 or 600 lb K_2O/ac and 0 or 500 lb NaCl/ac/yr during 1951–4 or 1951–6. Sugar-beet was grown during 1955–6. Where up to 300 lb K_2O/ac/yr was applied, NaCl increased the percentage of sugar in the roots in 1956 only and the yield of roots per ac in 1955 only, and increased yields of sugar/ac in both years. The effect of NaCl in increasing yield decreased with increasing rates of K_2O. At the highest rate of

K_2O, NaCl tended to depress yields. There appeared to be an inverse relationship between the K content and the Na content of plant tissues. Where 200–300 lb K_2O/ac were applied, the crop removed more K from the soil in the presence of NaCl than in its absence.—R.B.

1788 VELLARD, J. Sucre, non-sucre et acide glutamique dans la betterave sucrière : campagne 1959. **[Sugar, non-sugar constituent and glutamic acid in sugar-beet in 1959.]** *C. R. Acad. Agric. Fr.* 1960, **46,** No. 4, 155–7.

In 1959, determinations of sugar, non-sugar constituent and glutamic acid were made on the juice extracted from sugar-beet roots. Results, which confirmed as a whole those obtained in the previous year [see *Fld Crop Abstr.* 12 : 1837], showed an advantage from harvesting early and from processing roots which have root necks. A table gives the yields of sugar, non-sugar and glutamic acid from whole roots and roots without root necks, for diploid, polyploid and triploid varieties, harvested at the 173rd day of growth. Yields of all 3 constituents were higher from whole roots than from roots without root necks.—E.B.O.

1789 FINKNER, R. E. **Changes in raffinose content and other characteristics of sugar beet varieties during six different harvest dates.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10,** No. 5, 459–66, bibl. 10. [Amer. Crystal Sug. Co., Rocky Ford, Colorado]

Six varieties of sugar-beet were harvested at intervals of approximately 15 days from 15 Sept. to 1 Dec. The percentage of raffinose in the roots increased significantly and in a linear manner at successive harvests after 15 Oct., when the mean minimum temperature was near 34°F or below. The percentage of sucrose increased rapidly until frost occurred, and then declined slowly.—R.B.

1790 WOOLLEY, D. G. and BENNETT, W. H. **Glutamic acid content of sugar beets as influenced by soil moisture, nitrogen fertilization, variety and harvest date.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10,** No. 7, 624–30, bibl. 8. [Utah Agric. Exp. Sta., Logan]

Sugar-beet, var. US 22 Improved and Stewart's 53104-0, sown on 30 Apr. 1955, were given 0, 80 or 250 lb. N/ac. and irrigated when 20, 50 or 75% of the available soil water had been depleted. The percentage of glutamic acid in the roots was significantly decreased by increasing the soil moisture status. Increasing the amount of N applied, linearly increased the percentage of glutamic acid in the roots. Delaying the harvest from 8 Oct. until 11 Nov. had no significant effect on root glutamic acid. The glutamic-acid content of the root was proposed as a criterion for determining the N requirements of sugar-beet.—R.B.

1791 ORCHARD, B. **Growth analysis. The effect of soil moisture deficit on plant growth.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 77–8.

The work described in *Fld Crop Abstr.* 12 : 219 and 1836 was continued. Sugar-beet grown in a glasshouse received the following irrigation treatments : (1) minimal water stress maintained by frequent watering (17·4 in. water applied during early June to mid-Sept.) ; (2) early drought (1 drought cycle) as follows : when the water deficit had increased to 4·5 in., 0·5 in. water was applied; when the deficit had increased to 8·5 in. 2 weeks later, water was applied to restore the soil-water content to field capacity and plots were watered as for (1) from late July onwards ; (3) water was supplied as for (1) until 25 June only. Results were similar to those in 1955. By early August, plants receiving treatment (3) had less fresh weight and leaf area than those receiving (1). At the final harvest in late Sept., treatment (3) had decreased the total dry-matter yield by only 9% and its effect was mainly on the leaves. Results indicated that, provided that sugar-beet receives adequate water during establishment and early growth, irrigation in the later stages of growth is unlikely to be effective.—S.M.J.

1792 DONÀ DALLE ROSE, A. Nessun effetto di " prefioritura " in F_1 di piante trattate con acido gibberellico. **[No bolting in F_1 sugar-beet derived from plants treated with gibberellic acid.]** *Agricoltura d. Venezie* 1960, **14,** No. 2, 89–90, bibl. 1.

Seed from sugar-beet plants treated with gibberellic acid in 1958 [See *Fld Crop Abstr.* 12 : 1352] was sown in the field on 18 March 1959. The sugar-beets belonged to a spring-summer type and to an autumn-winter type. No bolting occurred in the plants obtained from this seed.—E.B.O.

1793 ULRICH, A. **Effect of competition on sugar beet plants in pot experiments.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10,** No. 5, 448–58, bibl. 24, illus. [Univ. California, Berkeley]

Sugar-beet, var. U.S. 75, was grown in vermiculite culture in 11-in. diam. pots from 2 May to 18 Oct. 1955 at 1–5 plants per pot and supplied with adequate nutrients. Yield of roots per pot and sugar per pot was significantly greater with 2 plants/pot than with 1 plant/pot, and was relatively constant where 2–5 plants were grown per pot. There was a linear relationship between weight per root and number of plants per pot where this number was 2 or more. Yields of tops, on a fresh-weight and dry-matter basis, significantly increased with increasing plant population up to 4 plants/pot.—R.B.

1794 Adams, S. N. **Fertilizer trials with sugar beet. 1. The "types of nitrogen" experiments.** *Brit. Sug. Beet Rev.* 1960, **28**, No. 4, 175–6. [Rothamsted Fld Sta., Dunholme, Lincoln]

It is recommended that, when farmyard manure is not given, 1–1·2 cwt N/ac should be applied to sugar-beet in the seed bed.—E.B.O.

1795 Brummer, V. Lannoituksen vaikutuksesta sokerijuurikkaan satton. **Effect of fertilization on the yield of sugar beet.** *Suom. Maataloust. Seur. Julk.* 1959, **94**, No. 13, 201–39, bibl. 38, English summary. [Res. Cent. Sugar Beet Cult., Helsinki]

For the cultivation of sugar-beet in Finland, which is of relatively recent date, fairly large amounts of fertilizers are necessary because of the short growing season and the general poverty of the soil. An account is given of manurial trials conducted in different parts of the country from 1953 to 1957, wherein plots received (a) PK + increasing doses of nitrate of lime, (b) NK + increasing doses of superphosphate, and (c) NP + increasing doses of muriate of potash. Basic fertilizing comprised, in kg/ha, 140 N, 270 P_2O_5, and 250 K_2O. Farmyard manure was not applied. The weight of washed beets and of tops, sugar content, values of ash (K + Na mg eq.) and noxious N were determined for the yield of each experimental plot. The following are some of the conclusions reached. Because of the short growing period and heavy dressings, sugar-beet seldom reaches physiological maturity at these northern latitudes (60° to 62°). Weather often has a greater influence on quality, and even on sugar content, than fertilizers have. Sugar content usually remains low, while ash and noxious N are exceptionally high, but the top yield is always abundant, healthy, and free from serious leaf diseases. The ratio between top and root is usually very high. Of the fertilizers, N produced the greatest increases in yield both for roots and tops, but it reduced the sugar content of the beets and increased their values of ash and noxious N. The application of quite large amounts of fertilizer is profitable. The optimal dressing of N in most cases is 93 kg per ha. Profitable amounts of phosphate range from 180 to 360 kg P_2O_5 per ha, depending on the readily soluble P in the soil. The optimal dressing with potash ranges from 125 to 375 kg K_2O per ha according to soil type and its content of readily soluble potash. F. Eng. s.—G.M.R.

1796 Davis, J. F. and others. **The effect of fertilizers on sugar beets including an economic optima study of the response.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10**, No. 5, 424–34. [Michigan Agric. Exp. Sta., East Lansing]

Sugar-beet, var. 5481, was sown on 7 May 1957 and given 0, 60, 100, 150, 255, 500 or 800 lb P_2O_5/ac and 0, 30, 75, 150, 250 or 400 lb K_2O/ac. All plots except those receiving no PK were given 50 lb 6-24-12 (NPK)/ac. N at 50 lb/ac was applied to all plots on 12 June, and the beets were harvested on 17 or 21 Oct. Yields of roots were considerably greater at the later than at the earlier date of harvest. Highest yields of roots were obtained with 150 or more lb P_2O_5/ac and 300 or more lb K_2O/ac. The most profitable rates of fertilization were 50–100 lb P_2O_5/ac and 250–325 lb K_2O/ac. K fertilization increased the percentage sucrose in the roots by 0·5%. The P and K content of petioles varied considerably during the growth of the crop and were of little value in predicting nutrient deficiencies or final yields.—R.B.

1797 Norfolk Agricultural Station. [**Experiments with sugar beet.**] *Rep. Norfolk agric. Sta. 1958-9* Sprowston, 1959, 11–13.

Sugar-beet sprayed with a systemic insecticide [not specified] yielded 4 tons/ac more than unsprayed sugar-beet, which became heavily infected with virus yellows. Placing the fertilizer 2 in. to the side and 1 in. below the seed when drilling gave better results than broadcast applications. A 98% control of weeds was obtained by spraying with propham and endothal [rates not given] before drilling, and then thinning rows twice by machine.—J.D.J.

FODDER-BEET

See also Abs. 2003.

1798† Dimitrijević, R. Uporedni ogledi s polušećernim sortama stočne repe. [**Comparative trials with fodder sugar-beet varieties with high dry-matter content.**] *Arhiv polj. nauke* 1960, **13**, No. 39, 3–16, bibl. 6, French summary.

Results are reported of the trials (organized by FAO in 11 countries of west, central and south Europe) with 16 fodder sugar-beet varieties, special attention being given to dry-matter yields of the crops when grown in semi-arid conditions, without fertilizers or irrigation. [See also *Fld Crop Abstr.* 13 : 778]. F. Fr. s.—M.H.

1799† Cervato, A. Sulla coltura della barbabietola a scopo foraggero in Val Nure. [**The growing of beet for fodder in Val Nure (N. Italy).**] *Ann. Fac. Agr., S. Cuore* 1959, **76**, No. 3, 13–41, bibl. 7, English and French summaries.

The results are given from trials in 1957–9, at 350 and 950 m alt., to compare varieties of fodder-beet and sugar-beet grown for fodder. The varieties Gimsing White and Bison, which have a medium sugar content, gave the highest yields of roots (up to 86,600 kg/ha) ; the polyploids Klein

W and Strube's yielded up to 54,000 kg of roots per ha and the highest amounts of dry matter (up to 13,300 kg/ha) with a high sugar content.—E.B.O.

1800 Missonnier, J. Essais de lutte contre la mouche de la betterave (*Pegomyia betae* Curtis — Diptères Muscidae). [**Trials to control the beet fly** (*P. betae*).] *Ann. Épiphyt., Paris* 1959, **10**, No. 1, 19–36, bibl. 23. [Sta. Cent. Zool. Agric., Versailles]

An account is given of field trials to study the chemical control of *Pegomyia betae* on fodder-beet, transplanted stecklings and directly-sown mother-plants of sugar-beet. Excellent control of the larvae of *P. betae* was obtained by treatment with one of the following preparations (in order of increasing persistency) : parathion, diazinon, chlorthion, endothion, gusathion, dipterex, dipterex-chlorthion, chlordane, dieldrin, heptachlor and diazinon-DDT (rates of application are given).—E.B.O.

TURNIPS

1801† Statens Forsøgsvirksomhed i Plantekultur. Radrensning af roer. [**Inter-row tillage of root crops.**] *Medd. 641 Stat. Forsøgsv. Plkult.* 1960, pp. 2.

In trials during 1953–8 at 8 locations in Denmark, swede-turnips and beet were subjected to the following row-tillage procedures : (a) 6 very superficial hoeings up to 7 July, (b) 3 superficial and 3 relatively deeper horse-hoeings up to 7 July, and (c) 3 superficial and 3 progressively deeper horse-hoeings up to 7 July, followed by relatively deep tillage mostly confined to the centre of the inter-row spaces, in September. With both crops, treatments (a) and (b) resulted in yields of 511 and 515 hkg roots/ha for beet and 782 and 791 hkg roots/ha for swedes, respectively. Treatment (c) resulted in a marked yield decline in both crops, with root yields of 493 hkg for beet and 753 hkg/ha for swedes. In further trials in which up to 6 inter-row cultivations with 2-row horse-hoes, 4-row tractor-driven hoes, the latter resulted in slightly higher root yields, but the differences were small.—P.J.B.

1802† Jansen, A. A. M. Een eenvoudige beregeningsproef met stoppelknollen. [**A simple irrigation trial with turnips.**] *Wet. Praktijk* 1960, 51. [LandbHogesch. Wageningen, Netherlands]

Turnips [*Brassica campestris* var. *rapa*] were sown in mid-July 1959 following early peas, and grown with or without irrigation. Soil moisture measurements indicated that evapotranspiration was 1 mm/day greater on irrigated than on non-irrigated plots. The crop was ready for harvesting on 23 Sept. Irrigation increased yields of fresh tops plus roots from 16,500 kg/ha to 62,400 kg/ha, yields of dry matter from 2300 kg/ha to 5400 kg/ha, and yields of crude protein from 400 to 720 kg/ha. Irrigation of the pea crop had no effect on turnip yields. Irrigation of the turnip crop increased N uptake by 20–40 kg/ha.—R.B.

1803 Reith, J. W. S. **Fertilizer placement for swedes and turnips.** *Emp. J. exp. Agric.* 1959, **27**, No. 108, 300–12, bibl. 11. [Macaulay Inst. Soil Res., Aberdeen]

Field experiments were carried out with swedes and turnips over a period of 8 yr to compare the effectiveness of band-placed and broadcast fertilizers. No advantage resulted from placing ammonium sulphate to the side of the seed row ; placement below the seed resulted in decreased stands and yields, especially in dry weather. 30–40 lb P_2O_5 placed 3–3·5 in. directly below the seed resulted in an increase of 3·6 ton swedes/ac over the corresponding broadcast treatment. No advantage was obtained from placing P fertilizer at the side of the seed row. Recovery of P was 27% from band applications compared with 18% from broadcast applications. Neither placement or broadcasting of muriate of potash effected yields or K uptake. There was no interaction between (a) broadcasting and (b) placing of superphosphate and muriate of potash. Placement of ammonium sulphate (40 lb N/ac) + muriate of potash (100 lb K_2O/ac) below the seed row resulted in a significant decrease in yield, but placement 2 in. to the side did not injure the seed and gave similar results to broadcasting.—S.M.J.

POTATOES

See also Abs. 1764, 1847, 1907, 2003.

1804 Bothe, F. and Veth, F. Geschlossene Anbaugebiete für Pflanzkartoffeln. [**Closed areas for seed potato production.**] *Kartoffelbau* 1960, **11**, No. 2, 36–7. [Vermehrer-Organisation Dietrich Homann KG., Ahnsbeck, Kr. Celle, W. Germany]

An account is given of successful production of virus-free seed potatoes on a 550-ha area near Celle in Lower Saxony. To the west, the area was bordered by a belt of forest and meadow several kilometres wide. To the east there was a 500 m-wide belt for cultivation of tested healthy potatoes. —D.B.

1805 Kawakami, K. and Takayama, A. **Studies on the improvements of potato culture by using suitable age of seed tubers. 3. Factors concerned with the suitable age of seed tubers.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 233–5, bibl. 12, illus., English summary. [Hyogo Agric. Coll.]

Sprouting and growth increased but yield decreased as the age of the seed tuber increased.

A suitable age for seed tubers is 2–5 months depending on varietal characteristics. Older tubers are preferred for an early crop and younger ones for main crop. [See also *Fld Crop Abstr.* 13 : 1286 and 1287.] F. Eng.s .—D.B.

1806 DE VRIES, K. Temperatuur poterbewaring en opbrengst. [**Seed potato storage-temperature and yield.**] *Landb Voorl.* 1960, **17,** No. 6, 282–3. [Rijkslandbouwconsulentschap Z.W.-Friesland, Sneek]

Bintje, Burmania and Rode Star seed potatoes 38–40 mm long were stored (a) at 5–14°C, (b) as (a) but transferred in mid-Feb. 1959 to a cowshed at *c.* 15°C for 16 days, then stored in the light at 5–14°C, (c) at 5–8°C, then for 10 days at the beginning of April at *c.* 15°C, (d) at 5–8°C. On the date of planting, 21 April, (a) had sprouts 1–1·5 cm long, (b) had sprouts 2–3 cm long, while (c) and (d) had very small sprouts. Yields at early lifting were lowered by treatment (d) ; to the greatest extent in the relatively early variety Bintje and least in the late variety Rode Star. Treatment (c) seemed advantageous for tubers destined for machine planting.—R.B.

1807 KARTOFFELBAU. Vorkeimen und Frühroden—wichtigste Massnahmen in der Pflanzguterzeugung. [**Pre-sprouting of potato tubers and early removal of tops. The most important measures in seed-potato production.**] *Kartoffelbau* 1960, **11,** No. 2, 28–35, illus.

This issue of *Kartoffelbau* contains several papers on chitting of seed potatoes and includes the following : The technique of pre-sprouting, by Schleusener (Lüneburg) ; The (partly) underground type of chitting house, by F. Bothe (Ahnsbeck) ; The communal chitting house (glass) in Stade, by P. Roosen (Stade/Hannover) ; Buildings with plenty of light and well regulated cool temperature for sprouting potato tubers, by E. Schomburg (Bremervörde) ; Experience with artificial light, by H. Krug (Braunschweig) ; Chitting of seed potatoes under conditions in Bavaria, by X. Artner (München) ; Experience in chitting potato tubers on a medium-sized peasant farm in Bavaria, by H. Forster (Westerham über Schrobenhausen/Obb) ; Manuring for sprouted tubers and early removal of tops, by Schröder (Oldenburg i.O.). —D.B.

1808 NORFOLK AGRICULTURAL STATION. [**Experiments with potatoes.**] *Rep. Norfolk agric. Sta. 1958-9* Sprowston, 1959, 13–14.

In the absence of late frosts, sprouted potato tubers, var. King Edward, yielded 1·5 tons ware/ac more than unsprouted tubers, irrespective of date of planting. In 1957 and '58 when soil at planting was moist, fertilizer placement raised yields by 0·75 ton/ac, but in the relatively drier year of 1959, broadcasting fertilizer resulted in earlier emergence and higher yields than did placement of fertilizer.—J.D.J.

1809 O'KEEFE, R. B. and WERNER, H. O. **Potato production in dryland rotations in western Nebraska throughout a twenty-three year period.** *Amer. Potato J.* 1959, **36,** No. 9, 325–32, bibl. 2. [Nebraska Agric. Exp. Sta., Lincoln]

In crop rotation studies carried out near Alliance, Nebraska from 1931 to 1953, highest yields of potato tubers were obtained where the soil was wet to field capacity to a depth of 5 ft at planting time and 2–3 in. rain fell in Aug. or early Sept. Economic yields (over 50 bu/ac) were obtained where at least 5–6 in. available moisture were present at planting. Where potatoes followed summer fallow, soil moisture was always adequate for potato growing and yields were higher than where crops were grown during the previous summer. Maize and other cereals reduced yields of a following crop of potatoes to a greater extent than did field beans [*Phaseolus vulgaris*]. Lowest tuber yields were obtained where potatoes were grown each year. Yields of potatoes grown in 5-year rotations were higher than those grown in 3-year rotations during 1941–53. F. S.—R.B.

1810 RIGOT, N. Performances de quelques variétés belges de pommes de terre. [**Performance of some Belgian varieties of potatoes.**] *Rev. Agric., Brux.* 1960, **13,** No. 1, 57–64.

Information, including yields, is given on the varieties Electre, Gari and Gaumaise.—E.B.O.

1811 PEDROTTI, F. Sulla vegetazione infestante le colture sarchiate in Val di Sole. [**The weeds of hoed crops in Val di Sole (Trentino, Italy).**] *Nuovo G. bot. ital.* 1959, **66,** No. 1–2, 344–5.

A list is given of weed species found in 30 surveys in potato crops at 700–1200 m alt., together with an indication of their frequency.—E.B.O.

1812 BACHTHALER, G. Auswertung von Witterungsdaten für den Krautfäule-Warndienst 1957 mit 1959 in verschiedenen Klimagebieten Niederbayerns. [**Evaluation of weather data for the potato-blight warning service 1957 to 1959 in several climatic areas of Lower Bavaria.**] *Prakt. Bl. PflBau* 1960, **55,** No. 1, 23–35, bibl. 5.

1813 KEDAR, N. **The peroxidase test as a tool in the selection of potato varieties resistant to late blight.** *Amer. Potato J.* 1959, **36,** No. 9, 315–24, bibl. 16. [Fac. Agric., Hebrew Univ. Jerusalem, Israel]

In tests with 23 potato varieties, a positive correlation was found between their resistance to *Phytophthora infestans* and leaf sap peroxidase activity. F. s.—R.B.

1814 Friebe, P. Warum und wie soll man Pflanzkartoffeln beizen ? **Why and how should one disinfect seed potatoes** ? *Kartoffelbau* 1960, **11**, No. 2, 37–8, illus. [Zuchtgut Gr. Coxbüll/Kr. Flensburg, W. Germany]

Disinfection protects tubers from *Rhizoctonia solani* which causes deformation of tubers. The disinfection consists of immersing the seed tubers for 1 min in a 5% solution of ceresan. If disinfected in autumn, trays of tubers are immersed, after which they are allowed to dry for 1 or 2 days before being placed in the chitting houses ; if disinfected in spring, they are removed from chitting houses for immersion and drying a few days before planting.—D.B.

1815 Burrage, R. H. **Insecticide row treatments for the control of wireworms in potatoes.** *Canad. J. Pl. Sci.* 1960, **40**, No. 1, 178–82, bibl. 5. [Canada Dep. Agric., Saskatoon, Saskatchewan]

Warba potatoes grown on wireworm-infested plots were treated in 1954 with aldrin, chlordane or heptachlor dusts at 1 or 3 lb a.i./ac, and, in 1955, with aldrin or heptachlor as dust, granules or impregnated fertilizer at 3 lb a.i./ac. The insecticide treatments were band-drilled by machinery or applied to the open furrow by hand. In 1954 and '55, 68 and 26% of the wireworms were *Ctenicera aeripennis destructor*, respectively, and the remainder *Hypolithus bicolor*. Approximately 20% of tubers on untreated plots were damaged by wireworms in both years, while less than 5% of tubers were damaged on plots treated with aldrin or heptachlor at either rate. Early Ohio potatoes grown in 1956 at another location at which 39% of the wireworms present were *C. aeripennis destructor* and 28% were *Limonius* spp. and *Aeolus* spp. yielded 40% damaged tubers on untreated plots. Aldrin at 3 and 1 lb/ac reduced the damage to 9 and 23%, respectively, and heptachlor at the same rates to 15 and 28%. None of the experimental treatments reduced wireworm populations by more than 75% or increased tuber yields. Furrow applications of aldrin and heptachlor reduced yields of tubers in 1955, probably because where this method was used the seed tubers were planted in contact with the insecticide.—R.B.

1816 Banham, F. L. **Soil insecticides for control of the tuber flea beetle, *Epitrix tuberis* (Gent.), in the interior of British Columbia.** *Canad. J. Pl. Sci.* 1960, **40**, No. 1, 165–71, bibl. 12. [Canada Dep. Agric., Kamloops, British Columbia]

Netted Gem [Russet Burbank] potatoes grown at 2 locations were treated with 4 soil insecticides or with DDT applied to the leaves at various rates during 1951–3 and 1955 for the control of *E. tuberis*. Plots treated with aldrin at 4 lb/ac, chlordane at 7·5 or 10 lb/ac, dieldrin at 1·5, 2 or 2·5 lb/ac or heptachlor at 3 or 4 lb/ac, harrowed into the soil, yielded more than 80% marketable tubers (containing 9 or less larval tunnels/tuber), compared with 0–57% marketable tubers from untreated plots. Foliar applications of DDT were inconsistent in effectiveness.—R.B.

1817 Banham, F. L. **Sprinkler irrigation as a means of applying soil insecticides for controlling the tuber flea beetle, *Epitrix tuberis* (Gent.), in the interior of British Columbia.** *Canad. J. Pl. Sci* 1960, **40**, No. 1, 172–7, bibl. 5. [Canada Dep. Agric., Kamloops, British Columbia]

Dieldrin emulsifiable concentrate, applied through sprinkler irrigation systems at 2 or 2·5 lb a.i./ac and harrowed into the soil, effectively controlled *E. tuberis* on Netted Gem [Russet Burbank] potatoes. Aldrin similarly applied at 4 lb a.i./ac was less effective than dieldrin. Where harrowing treatments were not applied, the insecticides did not penetrate more than 1 in. into the soil. F. s.—R.B.

1818 Landwirtschaftliche Versuchsanstalt Zürich-Oerlikon, Switzerland. **Igel-Lange test for potato tubers.** *Landw. Jahrb. Schweiz* 1958, **72**, 627–8 and 1959, **73**, 709.

The validity of the Igel-Lange test for detecting leaf-roll virus in seed tubers was determined in the field. Whether the total population or a sample of the population was examined, the percentage of tubers which had been wrongly diagnosed was extremely low, and lower for class A than class B tubers. The test could be carried out in good time for seed-tuber certification. Difficulties experienced with Ackersegen grown at higher altitudes were overcome.—D.B.

1819 Reestman, A. J. De teelt van aardappelen bij gebruik van pootgoed met matige gezondheidstoestand. [**The cultivation of potatoes using moderately healthy seed.**] *LandbVoorl.* 1960, **17**, No. 2, 64–70, bibl. 4. [Proefst. Akker. Weidebouw, Wageningen, Netherlands]

Potatoes saved for seed on the farm and replanted during successive years tend to be infected to an increasing degree with various virus diseases. On the basis of results from a number of trials, it was recommended that where it is impossible to avoid using such seed, these should be planted at a higher rate than healthy seed, and small, poorly developed plants should be removed from the

stand. Poorly sprouted tubers should not be planted. In trials with Bintje and Eigenheimer, virus-infected seed gave lower yields than healthy seed, but the percentage of large-sized tubers was greater.—R.B.

1820 PAQUIN, R. and others. Essai de différents produits chimiques comme désinfectants des éclats (germes) de pommes de terre inoculés avec *Corynebacterium sepedonicum.* **[Test of various chemicals as disinfectants for cut potato setts inoculated with *C. sepedonicum*.]** *Canad. J. Pl. Sci.* 1960, **40,** No. 2, 383–7, bibl. 10, English summary. [Lab. Rég. Rech., Min. Agric. Canada, Ste. Anne de la Pocatière, Québec]

Of 47 preparations tested, 0·2% $HgCl_2$ + 1% HCl in aqueous solution applied as a 10-min dip treatment alone gave satisfactory control of bacterial ring rot (*C. sepedonicum*) in inoculated cut potato setts. Seed potatoes showing 1% infection, treated with $HgCl_2$ before planting, yielded tubers apparently free from infection. F. S.—R.B.

1821 HEDOU, J. La vigueur végétative du plant de pomme de terre. **[The vegetative vigour of seed potatoes.]** *Pomme d. Terre franç.* 1960, **23,** No. 247, 3–11.

This article is based on results of investigations by P. Madec and P. Perennec [see *Fld Crop Abstr.* 10 : 620, 1056 and 1481, 12 : 1387 and 1867], from which some practical conclusions are drawn.—E.B.O.

1822 UNIVERSITY OF NOTTINGHAM. **Factors affecting plant growth. Potatoes.** *Rep. Nottingham Univ. Sch. Agric. 1959* 1960, 19.

Potatoes, var. Arran Pilot and King Edward, were chitted at 4 and 15°C, and the length, diameter and dry weight of sprouts at the different positions on tubers of different sizes were measured during growth. Apical sprouts were always larger on tubers kept throughout at 15°C but fewer sprouts developed than when tubers were kept at 4°C for 3 months before being transferred to 15°C. Potatoes grown in the field from tubers with large sprouts emerged earlier and produced a greater total dry weight of tubers than did unchitted tubers. Potatoes which were desprouted in Feb. developed small sprouts again by planting in April and gave a higher yield than tubers which retained their original sprouts, from which many stolons developed leafy branches. Tubers desprouted at planting gave reduced yields. In investigations over a wide range of light intensities and day lengths during chitting periods of 2 months or more at 15°C there were differences in sprout elongation and axillary branching between the different light treatments.—S.M.J.

1823 MAIERHOFER, E. Die " Knollenbildungsperiode " in der Beurteilung von Sämlingen und Kultursorten der Kartoffel. **[The tuber-formation period for assessing seedling plants and cultivars of potato.]** *Bodenkultur* 1959, **10,** No. 4, 342–50, bibl. 8, illus. [Kartoffelzuchtstation Kefermarkt der Oberösterreichiche Landes-Saatbaugenossenschaft]

Very early, early to medium-early, and medium-late varieties were planted on the same date under similar conditions and the plants sampled for tuber production on the same 8 dates between mid-June and early Sept. The very early varieties, e.g. Erstling, produced the greatest number of tubers at each sampling date. The very early and medium-early (e.g. Bea) varieties produced their maximum number of tubers at the second sampling date (24 June) after which the numbers fell, then remained constant. The medium-late varieties (e.g. Eva) produced their maximum number of tubers at a later date, but thereafter the number remained constant. The reduction in the number of tubers already formed (as in the early varieties) is attributed to the responses of these varieties to photoperiod and to weather during the tuber-formation period and brings about an optimal tuber/top ratio. The duration of the tuber-formation period is a varietal character. The relationship between duration of tuber-formation period, number of tubers and grading of tubers is discussed. The varieties with the highest proportion of tubers above 35 mm diameter were those with a short tuber-formation period, all medium-late ones. The good grading was especially evident in Stamm 52/25, a variety with an average of only 10·7 tubers per plant.—D.B.

1824 SZALAI, I. **Quantitative changes of growth-promoting and inhibiting substances in the potato tubers treated with rindite.** *Physiol. Plant.* 1959, **12,** No. 2, 237–44, bibl. 26. [Pl. Physiol. Inst., Univ. Szeged, Hungary]

[See also *Fld Crop Abstr.* 13 : 1308.] Potato tubers were treated with 0·8 ml/kg rindite [ethylene chlorhydrin] for 48 hr and then placed in wet sand with untreated tubers. Growth-promoting and growth-inhibiting substances were extracted with ether at 1, 8, 15, 22 or 29 days after treatment. Following rindite treatment, the quantity of growth-promoting substances increased rapidly, while that of growth-inhibiting substances decreased. An increase in the IAA content of the apical sector of the tubers was followed by a decrease on the 15th day, when bud development occurred, but the IAA content of the basal and middle sectors of the tubers continued to increase. The β-inhibitor content rapidly decreased in all sectors until the 29th day, when it rose again.—S.M.J.

1825 KRUG, H. and FISCHNICH, O. Entwicklungsbeeinflussung der Kartoffelpflanze

durch Gibberellin bei unterschiedlicher Tageslichtdauer. [**The effect of gibberellin on development of the potato plant under different daylengths.**] *Angew. Bot.* 1959, **33,** No. 5, 207–21, bibl. 41, illus. [Inst. PflBau u. Saatguterzeugung, Forschungsanst. LandwSch., Braunschweig-Völkenrode, W. Germany]

Under short day, gibberellin promoted growth in length of shoots of potato plants, and under long day it promoted flowering which it brought forward and increased. Gibberellin is therefore a useful aid in carrying out the Augenstecklings test for health of seed tubers and for accelerating breeding work. F. Ger. s.—D.B.

1826 BREYHAN, T. and others. Über das Vorkommen und die Bedeutung des Prolins in der Kartoffel. [**The occurrence and significance of proline in the potato plant.**] *Landw. Forsch.* 1959, **12,** No. 4, 293–5, bibl. 6, English and French summaries. [Forschungsanst. f. Landw., Braunschweig-Völkenrode, W. Germany]

The proline content of potato tubers varies under different storage conditions and in the presence of sprout-promoting or sprout-inhibiting substances. At the time of sprout formation proline is translocated from the tuber to the sprouts, but when these become green their proline content falls. It is suggested that proline is connected with chlorophyll formation and the probable course of the reactions is discussed. F. Ger. s. —D.B.

1827 GAUSMAN, H. W. and others. **An indication that chloride affects the phosphate esters in tubers of the white potato.** *Agron. J.* 1959, **51,** No. 12, 750–1, bibl. 6 in text, illus. [Maine Agric. Exp. Sta., Orono]

Katahdin potatoes were grown in culture solution containing 0 or 600 ppm Cl. Paper chromatography of tuber tissue samples revealed that considerably more fructose 1,6-diphosphate was present in tubers grown without Cl than in those grown with Cl. The concentration of P in the tubers was the same at both levels of Cl, while 0·33 g Cl/100 g dry matter was present in tubers grown with Cl compared with 0·105 g Cl in tubers grown without Cl. Cl may possibly affect esterification of organic P.—R.B.

1828 CORBETT, E. G. and GAUSMAN, H. W. **The interaction of chloride with sulfate in the nutrition of potato plants** (*Solanum tuberosum*). *Agron. J.* 1960, **52,** No. 2, 94–6, bibl. 19. [Maine Agric. Exp. Sta., Orono]

Katahdin potatoes were grown in sand culture in 1957 with 0, 100, 200 or 300 ppm Cl, and in 1958 with 0, 200, 400 or 600 ppm Cl. The culture solution also contained 20·8 ppm Cl as contaminant. ^{32}P, ^{36}Cl or ^{35}S were supplied at 0·2, 1 or 2 mc in 1957, and ^{32}P or ^{35}S at 2 mc in 1958, when 75% of the plants were in flower. Increases in the concentration of Cl in the nutrient solution decreased the uptake of SO_4 into the plant tops. The addition of ^{32}P significantly increased the uptake of SO_4 by roots compared with cultures not containing radioisotopes, or those to which ^{35}S was added. The uptake of ^{32}P was greater where 0 or 600 ppm Cl was supplied than where 200 or 400 ppm Cl was supplied. Plants receiving no Cl exhibited symptoms of Cl deficiency. Maturation was delayed and dry-weight of tubers was significantly reduced where 600 ppm Cl was supplied. —R.B.

1829 HARRAP, F. E. G. **Some aspects of the potash nutrition of the potato.** *J. Sci. Fd Agric.* 1960, **11,** No. 6, 293–8, bibl. 29. [Levington Res. Sta., Ipswich, Suffolk]

The K requirements of potatoes are described. In 11 experiments, the application of K_2SO_4 (50% K_2O) at given K_2O rates of application resulted in a higher dry-matter content of tubers than did KCl (60% K_2O). In 4 experiments, these increases were significant. The use of K_2SO_4 resulted in a more floury potato than did KCl. The dry-matter yield of the tubers increased considerably with rates of K fertilizer up to 180 lb K_2O/ac.—S.M.J.

1830 HOEKSTRA, O. De werking van nitraat- en ammoniakstikstof op aardappelen en suikerbieten. [**The action of nitrate- and ammonium-nitrogen on potatoes and sugar-beet.**] *Landbouwk. Tijdschr., Wageningen* 1960, **72,** No. 10, 403–10. [Rijkslandbouwconsulentschap, Goes, Netherlands]

Potatoes, var. Bintje, grown in 1956–8 on lime-rich soil poor in N were given 0, 55, 110, 165 or 220 kg N/ha, and sugar-beet 0, 45, 90, 135 or 180 kg N/ha, 0, 25, 50, 75 or 100% of which was in the form of nitrate-N and the remainder in the form of ammonium-N. Other plots were given the same levels of N in the form of 12-8-16 (NPK) compound fertilizer containing 25% NO_3-N in 1956 and 50% NO_3-N in 1957–8. P and K were applied to all plots at rates corresponding to the highest rate of compound fertilizer. The optimum rate of N for potatoes was 165 kg/ha. Increasing rates of N increased tuber size, and reduced cooking quality and weight of tubers under water. Compared with the optimum rate, 220 kg N/ha increased yields of tubers longer than 55 mm by 12% but total yields by only 1%. Ammonium-N slightly reduced yields and tuber size. Increasing rates of N applied to sugar-beet increased yields of tops and of roots, decreased the percentage sugar in the roots and increased the percentage of bolters. Yields of tops and roots were greater with nitrate-N than with ammonium-N. The optimum rate of N was

135 kg/ha for fertilizers containing 75% or 100% nitrate-N, and rather greater where more ammonium-N was present. In both crops, compound fertilizer produced somewhat greater yields than N, P and K applied separately at equivalent rates. —R.B.

1831 HUNGERBÜHLER, K. Vergleichende Stickstoffdüngversuche an Kartoffeln. [**Comparative manurial trials with potatoes.**] *Schweiz. landw. MH.* 1960, **38,** No. 2, 66–70. [Holzverzuckerungs-AG, Zürich]

1832 FISCHNICH, O. Die Erhaltung des Rohstoffwertes von Kartoffeln. [**The preservation of the raw-material value of potatoes.**] Paper read at Arbeitstagung der Kartoffelwirtschaft held in Detmold 24 April, 1959, pp. 32, bibl. 29, illus. [Inst. PflBau u. Saatguterzeugung, Braunschweig-Völkenrode, W. Germany]

This is a review of work already published by various authors on the storage of potatoes without loss of chemical constituents or nutrient value.—D.B.

1833 BERAHA, L. and others. **Effects of gamma radiation on some important potato tuber decays.** *Amer. Potato J.* 1959, **36,** No. 9, 333–8, bibl. 9, illus. [Agric. Mktg Serv., USDA and Dep. Bot., Univ. Chicago, Illinois]

Red Pontiac potato tubers were given 0, 91,280, 182,400, 273,840, 456,400, 684,600, 912,800 or 1,825,600 rads gamma radiation. Dosages of 182,400 rads and above caused progressively increasing internal damage to the tubers. Tubers inoculated with *Phytophthora infestans* were given 45,640–456,400 rads gamma radiation. All levels of irradiation controlled *P. infestans*, while *Fusarium* spp. were not killed at the highest dosage. *Erwinia carotovora* inoculated into tubers before irradiation caused typical potato soft rot where 17,700–477,400 rads gamma radiation was given. Dosages of 37,600 or 68,500 rads gave no control of *Pythium debaryanum.* Development of *P. debaryanum* rot was reduced to a greater extent where 137,000 or 157,600 rads gamma radiation was applied at 7000 rads/min than where applied at 3000 rads /min. At 182,400 rads, rotting occurred in samples treated at the slower, but not at the faster rate, while 228,000 rads gave complete control at both rates.—R.B.

SWEET-POTATOES

1834 RHODES, P. L. **The control of sweet potato weevils.** *Agric. J. Fiji* 1959, **29,** No. 4, 142–5.

The following recommendations are made for the control of *Cylas formicarius* and *Euscepes postfasciatus* attacking sweet-potatoes (*Ipomoea batatas*) : (1) use only resistant varieties and plant in at least a 2-yr rotation ; (2) dip sweet-potato slips, selected from weevil-free material, for 3 min before planting, using (a) a mixture of 1 fl. oz 15% dieldrin emulsion/gal water, except when the weather is hot and dry, or (b) 2 oz 50% wettable dieldrin powder in 3 gal water ; the same mixtures should be used for spray applications, 6 and 12–14 weeks after planting ; (3) harvest immediately the crop is mature.—S.M.J.

1835 ITO, H. and KATO, T. **Physiological factors in the tuberous root formation of the sweet potato plant.** *Tohoku J. agric. Res.* 1959, **10,** No. 4, 333–45, bibl. 5, illus. [Tohoku Univ., Sendai, Japan]

External supplements of carbohydrates and of NAA given (a) by immersion of cuttings before planting and (b) as foliar applications, promoted tuberization of roots of sweet-potato. The internal growth substance which caused tuberization of roots was shown to be IAA from the stems and leaf blades.—D.B.

1836 LUKAS, E. Der Welkeverlauf abgetrennter Organe und Organteile als Massstab der Trockenresistenz der Batate und einiger Vergleichspflanzen. [**The course of wilting of separated organs and parts of organs as a measure of drought resistance of sweet-potato and some other plants used for comparison.**] *Bodenkultur* 1959, **10,** No. 4, 330–41, bibl. 24, illus. [Inst. f. Obst- und Gartenbau, Hochsch. f. Bodenkultur, Wien, Austria]

CASSAVA

1837 COURS, G. and others. Le diagnostic phellodermique du manioc. [**The phelloderm diagnosis of cassava.**] *Bull. 3 Inst. Rech. agron. Madagascar* 1959, 22–33, illus.

In an investigation to apply the method of foliar diagnosis to cassava, difficulties were encountered in the choice of a suitable leaf. The variations in the content of N, P, K and Ca were examined in various organs of the plant. It was concluded that the phelloderm of the principal stem is the best organ for diagnosis because it can be easily examined at any season of the year and at all ages of the plant. An account is given of manurial trials.—E.B.O.

1838 BRIANT, A. K. **Manurial experiment on cassava.** *Bull 4/59 Dep. Agric. Zanzibar* 5–6.

In fertilizer trials at Kizimbani Experiment Station, cassava [*Manihot utilissima*] was planted in March 1958 and harvested in July 1959. Plots

received top dressings of 0, 2 and 4 cwt $(NH_4)_2SO_4$/ac, 0, 2 and 4 cwt muriate of potash/ac and 0, 10 and 20 tons f.y.m./ac, both applied at the base of the ridges. The total yield (all plots) was 14·11 tons roots/ac. An application of 10 tons f.y.m./ac resulted in a yield of 16·1 tons roots/ac, compared with 8·4 tons from untreated plots.—S.M.J.

KALE

1839† Langille, J. E. **Row versus broadcast seeding of rape and kale.** *Forage Notes* 1960, **6,** No. 1, 27–8.

Dwarf Essex rape [*Brassica napus* var. *biennis*] and marrow-stemmed kale [*Brassica oleracea* var. *medullosa*]were (a) sown in rows 3 ft apart at 1 lb seed/ac and thinned to 1 ft apart in the row, or sown broadcast at (b) 4 or (c) 5 lb seed/ac. The rape yielded (a) 3350, (b) 1563 and (c) 1801 lb dry matter/ac, and marrow-stemmed kale (a) 3080, (b) 1830 and (c) 2017 lb dry matter/ac, respectively, in 1 cut. The broadcast stand appeared to be too dense. Aftermath growth occurred to a significant extent on broadcast plots only.—R.B.

FIBRE CROPS

COTTON

1840 Sattar, A. **Cotton of the world.** *Pakistan Cotts* 1960, **4,** No. 2, 161–95, bibl. 45, maps.

This final instalment of the review on the cultivation, processing and marketing of cotton contains chapter 9 for Asia (mainly China, India, Pakistan, Turkey and Syria) and chapter 10 for Europe (Greece), Africa (mainly Egypt, Sudan, Uganda) and the Soviet Union. Chapter 11 contains a summary of the series, a world map of cotton-growing areas and tabulated data on world production.—D.B.

1841 Horowitz, M. La culture du cotonnier en Israël. [**Cotton-growing in Israel.**] *Cot. et Fibr. trop.* 1959, **14,** No. 3, 331–9, illus., English summary. [Sta. Rech. Agron., Beth-Dagan, Rehovoth]

1842 Paterson, E. C. **Peasant cotton cultivation in the Beihan Emirate.** *Emp. Cott. Gr. Rev.* 1960, **37,** No. 3, 209–11, illus.

An account is given of the cultivation on the S. Arabian coast of the perennial cotton *Gossypium herbaceum*.—C.L.S.

1843 Haas, R. Le coton au Pérou. Considérations générales. [**Cotton in Peru. General considerations.**] *Cot. et Fibr. trop.* 1959, **14,** No. 3, 323–30, English summary. [French Embassy, Peru]

1844 Jambunathan, L. R. **Study of the effects of different sowing dates on the fibre properties of 320F and 216F cottons in the Punjab.** *Indian Cott. Gr. Rev.* 1959, **13,** No. 6, 482–4, bibl. 2. [Technol. Lab., Abohar, Punjab]

These Punjab-American cottons recently introduced into this area were studied for mean fibre length, fibre weight/in., percentage of mature fibres, maturity coefficient and other qualities, and these properties were correlated with sowing dates at 12-day intervals between 31 March and 31 May. The variety 320F gave the best quality of fibre when sown between mid-April and mid-May, and 216F when sown from late April to end-May.—D.B.

1845 Wahhab, A. and Ahmad, R. **Manuring of cotton in West Pakistan. 2. Effect of date of sowing, irrigation, spacing between rows, and rate of manuring on the yield of seed cotton.** *Emp. J. exp. Agric.* 1960, **28,** No. 109, 35–43, bibl. 4. [Agric. Coll., Lyallpur, West Pakistan]

Investigations were carried out at 5 stations in W. Pakistan representative of different varietal zones. Optimum sowing dates for the Lyallpur, Wazirkot, Montgomery, Khanewal and Multan areas were late May, early May, late May – early June, early June and the 1st week in June, respectively. Four irrigations (3 in. each) were sufficient, provided that the total rainfall from May–Dec. was > 8 in., otherwise 6 irrigations were required. Provided that the cotton was sown early within the times recommended, 50–70 lb N/ac was economic, otherwise 75 lb/ac was necessary. At all centres except Wazirkot the 2-ft spacing between rows gave the best results. It was recommended that 75 lb N/ac, 2-ft spacing between rows, 4–6 irrigations of 3 in. (depending on rainfall) and early sowing should be used. F. s.—S.M.J.

1846 Wahhab, A. and Ahmad, R. **Manuring of cotton in W. Pakistan. 3. Effect of rate and kind of manuring and date of sowing on the yield of seed cotton.** *Emp. J. exp. Agric.* 1960, **28,** No. 109, 65–73, bibl. 6. [Punjab Agric. Coll., Lyallpur, W. Pakistan]

[See also previous Abs.] Further trials took place at the same 5 centres on the effects of sowing cotton at the normal sowing date and 1 month later, each combined with 6 N-treatments. The earlier sowing gave better yields than late sowing at all stations except Wazirkot. Applications of 75 lb N/ac resulted in yield increases of seed cotton of 2–3 maunds/ac (1 maund = 82 lb) at Lyallpur, 2 maunds at Khanewal and 3 at Multan. $(NH_4)_2SO_4$ was a more effective source of N for early-sown cotton than f.y.m. On the lower-yielding, late-sown cotton, f.y.m. alone or combined with $(NH_4)_2SO_4$ produced better responses than $(NH_4)_2SO_4$ alone.—S.M.J.

1847 MARYNEN, T. Précis de phytotechnie des principales cultures industrielles. [**Summary of cultural methods for the principal industrial crops.**] *Publ. INÉAC* 1960, pp. 112, bibl. in text, illus.

This publication summarizes information, based on experience in the Belgian Congo, on the management of various crops, among which are cotton (*Gossypium hirsutum*) and potatoes. The aspects considered include crop rotations, varieties, sowing or planting, spacing, manuring and harvesting. Trends in research are indicated.—E.B.O

1848 RAEV, B. G. [**Mechanization of cotton topping.**] [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1960, **10**, No. 2, 42–6.

1849 MUNRO, J. M. **Cotton-maize interplanting.** *Progr. Reps Exp. Stas Emp. Cott. Gr. Corp., Nyasald Protect. 1958-9* 1960, 6–7. [Makangar, Nyasald]

When maize and cotton were sown on alternate ridges, they yielded 3755 lb shelled maize and 1237 lb seed cotton from 2 ac, compared with 2904 and 959 lb respectively, from 1 ac of each grown alone. Cotton was sown at 20 lb and maize at 15 lb/ac, both on 18 Dec.—S.M.J.

1850 FRIZZELL, J. L. and others. **Some effects of handling on the growth and development of cotton.** *Agron. J.* 1960, **52**, No. 2, 69–70. [Arkansas Agric. Exp. Sta., Fayetteville]

The effect of experimental handling treatments, such as labelling individual plants, on the growth of cotton (*Gossypium hirsutum*) var. Plains, was investigated. The treatments applied were (a) walking parallel with the rows, (b) as (a), but manipulating the plants to simulate flower labelling or artificial pollination, (c) untreated. Insect control measures were taken in all plots. Soil compaction caused by walking along the rows had no measurable effect on plant growth. Handling treatments reduced plant height in proportion to the amount of handling applied. The effects of handling were temporary. Handling treatments had no significant effect on the number of bolls set, percentage of boll shedding, size of bolls, date of maturation or yield. F. S.—R.B.

1851 KHAN, A. H. and ALI, M. **Relative behaviour of indigenous (*Gossypium arboreum* L.) and Punjab-American (*Gossypium hirsutum* L.) cottons at Lyallpur.** *Pakistan Cotts* 1960, **4**, No. 3, 259–71, bibl. 20. [Cotton Res. Lab., Lyallpur, Pakistan]

The relative behaviour of indigenous *G. arboreum* (var. 231R) and Punjab-American cotton *G. hirsutum* (var. LSS) and the effect of different sowing dates (25 May, 5 and 15 June), row-spacings (2 ft and 2·5 ft), and manuring (0 and 50 lb N/acre) on these species were studied. Plants of the indigenous cotton were taller, had a more sympodial habit of branching, and produced more bolls per plant, higher yields of cotton and an earlier crop than the Punjab-American cotton. Spacing and manuring had no significant effect on yield. Delayed sowing, within the range of the experiment, did not significantly affect yield of indigenous cotton but resulted in shorter plants, fewer bolls per plant, and lower yields of the Punjab-American cotton. The indigenous species is adaptable to changes in environment caused by delayed sowing or bad weather and is resistant to attacks by jassids [*Empoasca devastans*] and white fly [*Bemisia tabaci*]. Although the shorter-stapled indigenous variety brings a lower price than the longer-stapled Punjab-American cotton, the former is more remunerative because of its higher yield.—D.B.

1852 KHAN, A. H. **362F, a new medium staple variety of cotton for Upper Thal. 231R, a new short staple variety of Desi cotton.** *Pakistan Cotts* 1960, **4**, No. 2, 151–2. [Cotton Res. Lab., Lyallpur, Pakistan]

1853 CALZADA, B. J. and CABALLERO, A. W. Selecciones de algodón para los valles de la Costa Central. [**Cotton selections for the valleys of the central coast of Peru.**] *Inf. 66 Div. Exp. agric. Minist. Agric. Peru* 1960, pp. 42, bibl. 13.

A summary is given of results from 239 plot trials carried out in different localities in Peru to test 41 cotton selections (sown crops or ratoons). The characteristics of the selections recommended for various areas are given.—E.B.O.

1854 MEMON, A. M. and others. **A note on the pedigreed cotton seed production, registration, certification, multiplication and distribution.** *Pakistan Cotts* 1960, **4**, No. 3, 251–8, bibl. 5. [Agric. Res. Sta., Tandojam, Pakistan]

1855 POINTEL, J. G. Les herbicides en culture cotonnière. [**Herbicides for cotton.**] *Agron. trop., Paris* 1960, **15**, No. 1, 38–46, English and Spanish summaries. [Office du Niger]

An account is given of trials in 1956–9 in French West Africa on the chemical control of weeds in cotton. The most common weeds present are listed. As shown by cotton yields, there was a clear advantage from applying diuron at 1 kg/ha, in addition to hoeing the crops 3–4 times.—E.B.O.

1856 PALMER, R. D. and ENNIS, W. B. **Periderm formation in hypocotyl of *Gossypium hirsutum* L. and its effect upon penetration of an herbicidal oil.** *Weeds* 1960, **8**, No. 1, 89–93,

bibl. 10, illus. [Mississippi Agric. Exp. Sta., State College]

Herbicidal oils entered the hypocotyl of *Gossypium hirsutum* through cracks formed in the periderm during secondary growth prior to the development of cork layers. The oils then penetrated the intercellular spaces and destroyed cork cambium, phloem parenchyma, vascular cambium and cortical parenchyma. These tissues were protected in older plants by the apparently oil-impervious cork layer.—S.M.J.

1857 Hlopkovodstvo. **[Combating diseases of cotton with nitrogen dioxide.]** [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1960, **10,** No. 2, 54.

A method for sterilizing cotton seed has been developed at the All-Union Research Inst. of Veterinary Science and the Uzbek Agricultural Institute. It consists of treating the seed in a hermetically sealed compartment with NO_2 (at a concentration of 50–100 g/cu. m) for 3–5 minutes. —M.H.

1858 Morton, D. J. **Progress report on cotton root-knot control for New Mexico.** *Res. Rep. 24 New Mexico Agric. Exp. Sta.* 1959, pp. 15, illus.

Land infested with cotton root-knot nematodes [*Meloidogyne incognita*] was treated with nemagon (4·3 lb 1,2-dibromo-3-chloropropane/U.S. gal), D-D (100% chlorinated C_3 hydrocarbons), dowfume W-85 (12 lb 1,2-dibromoethane/U.S. gal), fumazone (similar to nemagon), telone (similar to D-D), or dorlone (75·2% telone plus 18·7%, 1,2-dibromoethane). Nemagon applied at 1 gal/ac in irrigation water gave almost complete control of root-knot and doubled the yields of cotton. Where injected into the soil at 2 gal/ac before sowing, nemagon gave the most reliable control. Dowfume W-85 at the same rate gave economic control, but results were not so consistent as with nemagon. Dowfume W-85 at 3 gal/ac gave economic increases in cotton yields compared with the 2-gal rate, while increasing the rate of application of nemagon gave no noticeable yield increases. Nemagon applied as granules containing 8·6% a.i. at the equivalent of 2–3 gal/ac gave consistent economic control and required no special equipment for application.—R.B.

1859 Wene, G. P. and others. **Salt-marsh caterpillar control on cotton in Arizona.** *J. econ. Ent.* 1960, **53,** No. 1, 78–80, bibl. 2. [Arizona Agric. Exp. Sta., Tucson]

In trials in 1955 near Yuma, Arizona, to control *Estigmene acrea* on cotton by means of insecticides applied from aircraft, a dust containing 5% DDT, 15% toxaphene and 40% sulphur applied at 30 or 40 lb/ac gave 99–100% control; 2% parathion dust at 25 lb/ac gave 87% control; and a spray application of 0·5 lb methyl parathion /ac plus 1·5 lb toxaphene/ac gave 77% control. In similar trials in 1958 near Phoenix, dilan at 0·6 or 1 lb/ac gave consistent control of young larvae, while dylox at 2 lb/ac gave complete control of older larvae.—R.B.

1860 Weir, H. L. **Germination of cottonseed (*Gossypium hirsutum* L.).** *Proc. Ass. off. Seed Anal. N. Amer.* 1959, **49,** No. 1, 77–9, bibl. 11. [Arkansas State Plant Board, Little Rock]

Germination tests were made on 46 samples of cotton seed held at a constant temperature of 30°C and at alternating temperatures of 20°C [16 hr/day] and 30°C [8 hr/day]. Percentage germination was higher at the constant temperature in 39 samples and lower in 1 sample. The seeds germinated 2–5 days earlier at the constant temperature.—R.B.

1861 Grabe, D. F. **Technique for interpretation of tetrazolium tests.** *Proc. Ass. off. Seed Anal. N. Amer.* 1959, **49,** No. 1, 131–3, illus. [Mississippi Agric. Exp. Sta., State College]

Cotton seeds were soaked in water for 4 hr at 30°C, the testas were removed and the seeds placed in 0·1% tetrazolium violet for 2 hr at 40°C. After examination for staining pattern, the seeds were germinated for 3 days at 30°C. Seeds which stained uniformly well, and those with minor dead areas in the cotyledons, germinated normally. Immature, lightly-stained seed, and seed in which the root tips did not stain, produced abnormal seedlings, while those in which staining was absent, very light or abnormally dark, or in which large areas of the cotyledons remained unstained, failed to germinate.—R.B.

1862 Christiansen, Meryl N. and others. **Cotton seed quality preservation by a hard seed coat characteristic which restricts internal water uptake.** *Agron. J.* 1960, **52,** No. 2, 81–4, bibl. 13. [N. Carolina Agric. Exp. Sta., Raleigh]

Seed of a hard-seeded cotton variety, 16B7-2H, were soaked in water for 48 hr and seed which had become soft were discarded. The hard seed, and seed of the soft-seeded variety DES 8948, were delinted with acid, dried to 6% moisture and stored at 10°C. Samples of the seed were further dried to 5–5·2% moisture and stored at 30°C and 95% relative humidity for 28 days. The moisture content of soft seed increased to 22% within 10 days, whereas that of hard seed was 16% after 28 days. The percentage germination of soft seed deteriorated rapidly after 14 days, and after 28 days was 26% compared with 98% for hard seed. The percentage of free fatty acids in the oil contained in the seeds increased from 0·6 to 1·8 in

soft seed and from 0·2 to 0·9 in hard seed after 28 days at 95% relative humidity. Samples of hard and soft seed containing 6% moisture were stored for alternating 48 hr periods at 95% and 0% relative humidity for 16 days. The percentage of free fatty acids in the oil increased from 0·5 to 0·9 in soft seed, but remained unchanged in hard seed. —R.B.

1863 Sadykov, S. S. and Nazirov, N. N. **[Change in earliness of cotton in relation to conditions of growth.]** [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1960, **10**, No. 2, 27–32. [Inst. Pl. Physiol., Acad. Sci., Uzbek SSR]

A study was made of the light and temperature regimes in the cotton plant in order to devise a method for increasing earliness and yields (as features of inheritance) by controlling the environment. The material comprised different varieties of cotton which varied in duration of the vegetative period under Uzbekistan conditions. Early-ripening types require less total warmth during the period from sowing to flowering and ripening than do late types. One of the main factors which cause instability of heritable characters and produce the annual feature [annuality] together with early ripening is low temperature (in the continental climate) during the early and final developmental phases of the cotton crop. Types which differ in their origins and earliness do not react uniformly to daylength. There is evidence that early types differ from late forms in their greater capacity for adaptation to long day and to less warmth at the beginning and end phases of ontogenesis. During 1957–8 the authors studied the dynamics of free sugars and amino-acids in addition to the oxidation-reduction processes in leaves of the following *Gossypium hirsutum* varieties : the early 1306-DV ; late C-460 ; F-285 from North India ; and Vagu from Central India, together with one semi-wild type (*punctatum*) and one ancient wild type (*mexicanum*). Sowing was at the end of April, in 10–12 replications. The content of free sugars and amino-acids in the leaves fluctuated sharply during 24 hr, the maxima being in the morning, after which the amounts gradually declined until the night when accumulation again began. In the *punctatum* and *mexicanum* forms, however, under natural day in Taškent, the content of ketose rose throughout the day, to a maximum at night. In early-ripening types, the oxidation processes were more active and reduction slower than in late forms. In short day peroxidase activity in the leaves increased, while the reduction capacity of the tissues and content of free sugars and amino-acids were lowered. Prolonging the light regime by incandescent lamps resulted in a lowering of peroxidase activity and of the contents of ketose and free amino-acids, while reduction capacity and the amount of monosugars (glucose) increased. This was most marked in late varieties and wild types. Prolonging the photoperiod did not affect metabolism in the early 1306-DV. Prolonging the light period by means of incandescent and daylight lamps lowered the content of ketose and free amino-acids in the cotton plant. Under these conditions cultivated cotton had a lowered content of glucose but in wild types, on the contrary, glucose was considerably increased. The authors maintain that an accumulation of glucose in the leaves is one of the factors retarding cotton development in an unfavourable day-length. A study of the physiological/biochemical features in different cotton varieties should facilitate the selection of early types which give good yields. —M.H.

1864 Johnson, S. P. **A preliminary study of the effect of low concentrations of phenoxy-type growth regulators on early physiological shedding in Deltapine, TPSA, cotton : 2. Influence on flower initiation.** *Agron. J.* 1960, **52**, No. 5, 294–5, bibl. 2 in text. [Texas Agric. Exp. Sta., College Station]

Cotton seed was soaked for 24 hr in 0·1 or 0·01 ppm NAA, or in 0·1, 0·01, 0·001 or 0·0001 ppm 4-CPA, and sown in warm soil (*c.* 75°F) with or without exposure to 4°C for 7 days after treatment prior to sowing. Where low temperature treatment was given, the highest concentration of 4-CPA prevented seedling emergence, and 4-CPA at 0·01 ppm inhibited axillary bud and internode development so that reproductive branches first appeared on higher nodes than in untreated cotton. Other treatments had no effect on the position of the lowest reproductive branch. [See *Fld Crop Abstr.* 10 : 235].—R.B.

1865 Munro, J. M. **Cotton shedding.** *Progr. Reps Exp. Stas. Emp. Cott. Gr. Corp., Nyasald Protect. 1958-9* 1960, 5, [Makanga, Nyasald]

In an investigation of factors affecting the setting of cotton, spraying with a fruit-drop hormone [not specified] and a wider spacing of rows [not specified] advanced the harvesting date by 2 weeks and 1 week, respectively. Most of the shedding appeared to be due to physiological factors ; spraying with insecticide had little effect on the incidence of shedding.—S.M.J.

1866 Neirinckx, L. J. A. Étude des effets de la carence borique sur le cotonnier. **[A study of the effects of B deficiency on cotton.]** *Ann. Physiol. vég., Univ. Brux.* 1960, **5**, No. 1, 1–18, bibl. 22, illus. [INÉAC Sta., Bambesa, Belgian Congo]

In the experiment described, Stoneville cotton was grown in pots filled with sand from the Uele river, with a nutrient solution containing all the major elements, and with or without Fe, B, Mn, Zn and Cu. It was found that B was of great importance for growth and fruit-formation of cotton,

while the other micronutrients had little effect when applied singly. The highest yields, however, were obtained when all the micronutrients were applied. The symptoms of B deficiency are described ; this deficiency results in a considerable increase in boll-shedding and a loss in the yield of seed cotton.—E.B.O.

1867 CARAMELLI, J. E. Espesor de la pared celular en fibra de algodón argentino. **[Thickness of the cell wall of fibre of Argentinian cotton.]** *Idia* 1959, No. 144, 15–18, bibl. 15, illus.

The average thickness of the cell wall of the fibre of cotton grown in Argentina is about 2·5 microns, which is about 1 micron lower than that of cotton grown in the USA. This difference is thought to be caused by environmental factors, possibly by a deficiency of water during the period when cellulose is deposited in the fibre.—E.B.O.

1868 GUTKNECHT, J. Variations des caractéristiques technologiques de quelques variétés de coton cultivées aux États-Unis. **[Variations in the technological characteristics of some cotton varieties grown in the USA.]** *Cot. et Fibr. trop.* 1959, **14**, No. 3, 395-427, bibl. 7, English summary.

Investigations were carried out over several years to study the variations in some technological characteristics of varieties of Upland cotton grown in the USA. In particular, staple length and grade were studied during 1928–58. It was concluded that cotton quality is influenced considerably by environment and climate during growth.—E.B.O.

1869 NAKAMURA, and others. **Studies on the cultivation of upland cotton, especially in regard to its blooming and ripening. 3. The effects of different sowing dates on the numbers of convolution in cotton fibre.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 226–7, bibl. 6, English summary. [Hyogo Univ. Agric.]

1870 SCARSBROOK, C. E. and others. **The interaction of nitrogen and moisture on cotton yields and other characteristics.** *Agron. J.* 1959, **51**, No. 12, 718–21, bibl. 6. [Alabama Polytech. Inst., Auburn]

Cotton was grown in 1956 and 1957, with N applied at 0, 60, 120 or 240 lb/ac. Some plots were irrigated when the average moisture tension in the top 2 ft of soil reached 7·75 or 2·45 atm. in 1956 and 4·8 or 1·7 atm. in 1957. The highest moisture and N levels produced the largest yield (1794 lb lint/ac). Nitrogen increased the efficiency of water utilization. At the highest moisture level the yield per ac–in. of water was 29 lb lint/ac without N and 57 lb lint/ac where 240 lb N were applied per acre. There was a direct relationship between the N content of the plants in late July and the eventual yield when moisture was ample, but not on non-irrigated plots where moisture was often deficient. The N content of the plants varied directly with N applications at all moisture levels, but the higher the moisture level the greater was the N uptake. The combination of high rates of N and ample moisture decreased the ginning %, increased boll rot, boll weight and lodging, and delayed maturity. F. s.—A.M.H.

1871 WAHHAB, A. and AHMAD, R. **Manuring of cotton in West Pakistan. 4. Effect of the source of nitrogen on the yield of seed cotton.** *Emp. J. exp. Agric.* 1960, **28**, No. 110, 145–50, bibl. 20. [Agric. Coll. and Res. Inst., Lyallpur, W. Pakistan]

Various organic and inorganic sources of N were applied to cotton at the rate of 50 lb N/ac. Organic sources gave relatively lower increases in yield. Urea and $(NH_4)_2SO_4$ gave similar increases in yield but urea was found to be the cheaper source of N for cotton. F. s.—S.M.J.

FIBRE FLAX

See also Abs. 1883.

1872 JOURDHEUIL, P. Observations sur les altises du lin. Remarques sur la biologie et les méthodes de lutte. **[Observations on the biology and control of flea beetles on fibre flax.]** *C.R. Acad. Agric. Fr.* 1960, **46**, No. 8, 477–80, bibl. 7. [Sta. Cent. Zool. Agric., France]

Preventive measures are recommended for the control of *Longitarsus parvulus* and *Aphthona euphorbiae* on fibre flax. In trials in 1957–9 excellent control was obtained during the germination of flax seed and until at least 10 days after emergence by dusting the seed (treated with an oily substance to increase adherence) with lindane at 100–150 g/100 kg of seed. Germination was not affected.—E.B.O.

1873 GULLINE, Heather F. **Experimental morphogenesis in adventitious buds of flax.** *Aust. J. Bot.* 1960, **8**, No. 1, 1–10, bibl. 11, illus.

1874 STRONG, R. G. and LINDGREN, D. L. **Effect of methyl bromide and hydrocyanic acid fumigation on the germination of flax seeds.** *J. econ. Ent.* 1960, **53**, No. 1, 17–19, bibl. 7. [Univ. California Citrus Exp. Sta., Riverside]

Flax seed, var. Imperial, with moisture contents of 6, 8, 10 and 12% was fumigated with HCN for 72 hr at 50, 70 or 90° F. No significant reduction in percentage germination occurred. Similar seed samples were fumigated with CH_3Br

for 2, 8, 24, 48 or 72 hr at 50, 70 or 90°F. Moisture content, period of exposure, temperature, dosage of fumigant and repeated fumigation appeared to have some effect on percentage germination after fumigation, but results were erratic and it was difficult to distinguish between the respective effects of these factors. The percentage germination of seed of Punjab flax fumigated with CH_3Br for 72 hr was similar to that of correspondingly treated Imperial flax.—R.B.

JUTE

1875 Chang, H. S. **Jute improvement in Taiwan.** *Proc. Soil and Crop Sci. Soc. Fla* 1958, **18**, 327–33. [Chinese-American Joint Commission on Rural Reconstruction, Teipei, Taiwan] [Received Dec., 1959]

Preliminary trials showed that jute sown in Dec. would produce mature seed in time for sowing in April for a fibre crop, thus avoiding the danger of seed shortages caused by typhoon damage. Transplanting jute seedlings grown in irrigated nursery beds was a promising means of overcoming the problem of overcrowded planting schedules on the same piece of land and of avoiding drought in the sowing season. Transplanted jute yielded as well as that treated normally.—A.M.H.

1876 Datta, R. M. **Polyembryony in *Corchorus olitorius* Linn. (Wild)** *Sci. and Cult.* 1960, **25**, No. 11, 642, illus. [Dep. Agric., Univ. Coll. Sci., Calcutta, 19, India]

Polyembryony is reported in jute for the first time. Among germinating seeds of wild plants of *Corchorus olitorius* one seed produced twin seedlings with 2 plumules and 2 radicles.—D.B.

KENAF

1877 Lanuza, E. A. and Garcia, A. C. **A study on harvesting kenaf at different ages for fiber production in the Philippines.** *Philipp. J. Agric.* 1957, **22**, Nos 1–4, 109–18, bibl. 9, illus. [Publ. 1959] [Bur. Pl. Indust., Philipp. Dep. Agric., Manila]

Kenaf [*Hibiscus cannabinus*] was sown on 12 May 1955 and harvested after 80, 90, 100, 110 or 120 days. Yields, tensile strength and length of fibre increased as harvesting was delayed, while fibre quality and elasticity decreased. Kenaf harvested after 80 or 90 days was similar in quality to jute, while that harvested more than 100 days after sowing was of poor quality and unsuitable for sack manufacturing.—R.B.

1878 Simonneau, P. and Morel, P. La culture de l'*Hibiscus cannabinus* en sols salins. [**The cultivation of *H. cannabinus* on saline soils.**] *Bull. 5 Travaux Sect. Pédol. Agrol. Alger* 1959, pp. 65. [Summary seen in *Bull. agric. Congo belge* 1960, **51**, No. 1, 259]

From trials with kenaf in Algeria in 1958, the following conclusions were drawn : sowing should be very early, and harvest should begin in September ; the soil should be level and well drained ; mechanized harvesting is profitable only where yields reach 2 metric tons of bast fibre per ha.—E.B.O.

1879 Garcia, A. C. and Asico, P. M. **Important characters of kenaf stalk associated with fiber yield.** *Philipp. J. Agric.* 1957, **22**, Nos 1–4, 89–95, bibl. 3. [Publ. 1959] [Bur. Pl. Indust., Philipp. Dep. Agric., Manila]

Studies on several varieties of kenaf [*Hibiscus cannabinus*] indicated that the length, weight and basal diameter of kenaf stems were positively correlated with fibre yield. Fibre yield and percentage fibre recovery were positively correlated in the case of stems having similar fresh weights. Fresh weight of stems and percentage fibre recovery were negatively correlated. F. s.—R.B.

OIL CROPS

SESAME

1880 Mazzani, B. and Cobo, Margarita. Efectos de diferentes distancias de siembra sobre algunos caracteres de una variedad no ramificada de ajonjolí. [**Effect of different spacings on some characters of an unbranched variety of sesame.**] *Agron. trop., Maracay* 1958, **8**, No. 3, 109–14, bibl. 3, English summary. [Centro Invest. Agron., Maracay, Venezuela]

In 2 plot trials the sesame variety "aceitera" [oil type] was grown at 9 plant densities ranging from 71,400 to 666,000 plants per ha. The highest densities gave seed yields up to 62% higher than those obtained from low densities. The height above ground of the first formed fruits was greater at the highest densities, while plant height was not affected.—E.B.O.

1881 Borrego, J. and Sanchez, N. Estudios con ajonjolí en el noroeste. [**Studies on sesame in northwest Mexico.**] *Agricultura téc., Méx.* 1959, No. 8, 30–1, illus. [Cent. Invest. Agríc. Noroeste, Ciudad Obregón, Mexico]

In a sowing-date trial in which the sesame variety Instituto 15 was sown at monthly intervals from 15 Feb. to 15 Aug., the highest yields, 1389 and 1486 kg of seed per ha, were obtained from sowing on 15 March and 15 Apr., respectively. As a result of a varietal trial, Instituto 15 is recommended. The pests *Heliothis* spp. and *Laphygma exigua* were controlled by one application of 2% endrin at 18 kg/ha.—E.B.O.

1882 Kluijver, H. and Smilde, K. W. **Influence of the photoperiod on the oil percentage of sesame seeds** (*Sesamum indicum* L.). *Neth. J. agric. Sci.* 1960, **8**, No. 1, 11–14, bibl. 5. [Lab. Trop. Agric., Wageningen, Netherlands]

Sesame of the U.S. variety Early Russian was grown in a glasshouse in 1959 at maximum temperatures of 31–35°C, minimum temperatures of 15–20°C, and (a) 6, (b) 8, (c) 10, (d) 13 hr daylight, with (a) 0, 4, 7, 14, (b) 0, 2, 8, 12, (c) 0, 3, 6, 10 hr fluorescent supplementary light at 2000 ergs/sec/sq.cm. The percentage of oil in the seeds increased with increasing photoperiods in excess of 10 hr. Within photoperiods, those plants receiving the highest percentage of daylight produced seed containing most oil.—R.B.

OIL-SEED FLAX

1883 Garber, K. Über Leinsortenversuche in Schleswig-Holstein unter besonderer Berücksichtigung der Werteigenschaften. [**Varietal trials with flax in Schleswig-Holstein with special reference to quality.**] *Qual. Plant. et Materiae veg.* 1960, **7**, No. 2, 159–83, bibl. 19, English summary. [Staatsinst. Angew. Bot., Hamburg, W. Germany]

Fibre flax var. Daros, Eckendorfer Frühflachs and Eckendorfer Stamm 338/44, and oil-seed flax var Roland and Endress were sown in rows 15 cm apart and given 25 kg N, 100 kg P_2O_5 and 60 kg K_2O/ha, with or without a top-dressing of 20 kg N, 100 kg P_2O_5 and 60 kg K_2O/ha. Except in Endress, top-dressing increased the 1000-seed weight and reduced yields of fibre. Top-dressing decreased the percentage of oil in the seed, especially in Endress, but increased oil yields/ha except in Eckendorfer Stamm 338/44. Roland yielded most seed and most oil, Eckendorfer Stamm 338/44 most fibre, and Daros the highest quality fibre. In 2 trials at 14 locations, the varieties Daros, Concurrent, Eckendorfer Frühflachs, Heges Hohenheimer, Lusatia, and the hybrids Stamm 36 and Stamm 72 were grown. In one trial, Concurrent yielded most fibre, while in the other Lusatia gave highest fibre yields, although Concurrent stems contained a higher percentage of fibre. Hybrid varieties gave the lowest yields at both locations. In further trials, Svalöf's Kristina gave high yields of oil and of high-quality fibre, while Formosa gave high fibre yields, but poor oil yields. In row-spacing trials, the optimum seed rate was 150–160 kg/ha and the optimum row-spacing 8 cm. Early spring was the most favourable time for sowing. Late-sown crops tended to produce poor-quality fibre. Seed disinfection and an adequate supply of P and K were essential to ensure the production of high-quality crops.—R.B.

1884 Culbertson, J. O. and others. **Further studies on the effect of seed coat color on agronomic and chemical characters and seed injury in flax.** *Agron. J.* 1960, **52**, No. 4, 210–12, bibl. 1. [Minnesota Agric. Exp. Sta., St. Paul]

Thirteen pairs of isogenic lines of oil-seed flax, each pair of which was assumed to be essentially identical except that one of each pair of lines were homozygous for yellow seed colour and the other for brown seed colour, were grown in field trials in 1958. The date of first bloom, full bloom, last bloom and seed ripening, the height of plants, lodging, test weight, seed size, percentage of damaged seed, oil content of seeds, iodine number and seed yields were recorded. Seed colour was significantly associated with all of the above characteristics except lodging and date of last bloom. Lines with yellow seed flowered later, ripened later, were slightly taller, and yielded less, but slightly larger seed, containing more oil of a higher iodine number, than lines with brown seed. Yellow seed had a higher percentage of damage and infestation with *Alternaria* spp., and a lower percentage germination, than brown seed. [See *Fld Crop Abstr.* 9 : 909]—R.B.

RAPE

1885 Schulz, K. and Troll, H.-J. Beobachtungen über Winterfestigkeit und Spätsaatverträglichkeit von Winterraps, Winterrübsen und ihren Bastarden. [**Observations on winter-hardiness of winter rape, winter turnip rape and their hybrids and their ability to tolerate late sowing.**] *Z. Acker- u. PflBau*, 1959, **109**, No. 4, 430–41, bibl. 8, English summary. [Inst. Acker- u. PflBau, DAL, Müncheberg/Mark, E. Germany]

There were 4 sowing dates, at 10-day intervals between 20 Aug. and 20 Sept. With later sowing there was a marked decrease in seed yield, a reduction in oil content of seed, and plants were shorter. This last feature was a day-length effect on the early stages of growth ; but in April and May, growth in length was determined by temperature. Under the conditions of Müncheberg/Mark, turnip rape [*Brassica campestris* var. *oleifera* subvar. *biennis*] was less winterhardy than rape [*Brassica napus* var. *oleifera* subvar. *biennis*].—D.B.

1886 Downey, R. K. **1959 rapeseed yield results.** *Forage Notes* 1960, **6**, No. 1, 29–30.

Seed yields are given for 5 varieties of *Brassica napus* var. *oleifera* subvar. *annua*, 3 varieties of *B. campestris* var. *oleifera* subvar. *annua* and 1 variety of *Crambe abyssinica* for 3 regions of W. Canada. Yields were highest in cool, moist areas.—R.B.

1887 Jamalainen, E. A. Abioottisista tekijöistä johtuvista syysrypsin talvehtimisvaurioista. **Overwintering damage in winter turnip rape**

caused by abiotic factors. *Suom. Maataloust. Seur. Julk.* 1959, **94**, No. 8, 109–19, bibl. 5, illus., English version. [Agric. Res. Centre, Tikkurila, Finland]

Poor overwintering of winter turnip rape (*Brassica campestris* var. *oleifera* subvar. *biennis*) in Finland may occur in places and years with little or no snow, in which case the plants are subject to direct freezing injury. In most cases, however, it is in regions of heavy snow where this plant overwinters poorly. The cover of snow is abundant every year in central, eastern and northern Finland and generally also in southern Finland. Its effect is twofold : partly abiotic, resulting in an extensive layer of standing thaw-water under the snow in spring, creating a condition of inadequate aeration and resulting in injury or death of the plants ; and partly biotic, allowing low-temperature parasitic fungi to damage the plants during the winter. F. s. —G.M.R.

1888 VAN ROON, E. De toepassing van gedeelde stikstofgiften bij enkele zaadgewassen. **The application of divided nitrogen dressings to some seed crops.** *Publ. 6 Proefst. Akker. Weidebouw* 1959, pp. 131, bibl. 81, illus.

Poppy [*Papaver somniferum*] and winter oilseed rape [*Brassica napus* var. *biennis*] were grown with 45, 50, 90, 100, 135 or 150 kg N/ha applied at sowing, as a top-dressing or as split applications. In the case of poppy, increasing the amount of N applied at sowing increased branching and the number of flowers per plant, but decreased the seed yield per capsule. Top-dressing and split applications increased seed yields, number of seeds per capsule and 1000-seed weight. Highest seed yields were obtained where one-third of the N was applied at sowing and two-thirds as a top-dressing. The optimum stage of growth for applying the top-dressing was 3–7 days before flowering. Split applications did not increase dry-matter production. Increasing levels of total N increased lodging, especially where a top-dressing was applied during stem elongation. Earthing-up the plants reduced lodging and considerably increased seed yields. The increase in seed yield obtained where urea at 15, 30 or 45 kg N/ha was sprayed on to the plants was similar to that obtained where nitrochalk was applied at corresponding levels of N. Solutions as concentrated as 100 kg urea in 400 l water had no deleterious effects. Split applications of N had no significant effect on seed yields of winter rape, but caused a slight decrease in oil content and oil yields/ha, compared with where all the N was applied early in the season. Heavy applications of N late in the season tended to cause uneven seed ripening.—R.B.

1889† BLACKITH, R. E. and LUBATTI, O. F. **The influence of oil content on the susceptibility of seeds to fumigation with methyl bromide.** *J. Sci. Fd Agric.* 1960, **11**, No. 5, 253–8, bibl. 8. [Imperial Coll. Fld Sta., Sunninghill, Berks]

Batches, each of 200 g rape seed [? *Brassica napus* var. *oleifera*] with moisture contents of 6·7, 10·3, 13·3 or 16·2%, were fumigated with CH_3Br at 3 concentrations in the range 290 – 330, 550 – 570, and 830 – 870 mg/hr/l, respectively, at a temperature of 20°C. After storage at 20°C the seed was tested for germination and oil content. At 7% moisture content the seed had over 89% germination capacity, but at moisture contents higher than 7%, germination capacity declined rapidly. The presence of substantial amounts (36·5%) of oil in the seed rendered it only slightly more susceptible to CH_3Br at the lowest moisture content, but at the higher moisture contents the deleterious effect of the oil content was greatly increased.—S.M.J.

POPPY

See also Abs. 1888.

1890 ANDERSSON, G. Svalöfs Original Flora II vallmo. **Svalöfs Original Flora II poppy.** *Sverig. Utsädesfören. Tidskr.* 1959, **69**, No. 4–5, 231–6, English translation.

The oil-seed poppy [*Papaver somniferum*] variety Flora II is compared with Flora I, from which it was selected, and its parental varieties Peragis and Mahndorfer. The mean seed yield of Flora II at 4 centres was 1534 kg/ha and was 6, 12 and 15% higher than that of Flora I, Mahndorfer and Peragis, respectively. The oil contents of the seed of Flora I and II and Mahndorfer were similar and in all cases were higher than that of Peragis. Flora II had a stronger stalk than the other varieties, excluding Peragis, and ripened 1 day earlier than Flora I. No difference in morphia content between Flora I and II was noted.—S.M.J.

MUSTARD

See also Abs. 1586.

1891 BARDNER, R. and DOHERTY, T. **Seed-dressings to control mustard pests.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 129–30.

Heptachlor, γ-BHC, parathion, aldrin, dieldrin, endrin, DDT, toxaphene, dipterex, rogor, sevin, thimet and W.L. 1650 (a chlorinated hydrocarbon) were applied at rates of 10% of the seed weight to Trowse mustard [*Brassica juncea*]. In tests made when the plants were about 2·5 in. high and had 2 pairs of rough leaves, thimet killed 84% of *Phaedon cochleariae* caged on the foliage for 48 hr and rogor killed 54%. When the plants had reached 6–9 in. high, the toxicity of the seed treat-

ments had disappeared. Thimet and γ-BHC, tested at 3 rates and at 3 sowing dates, protected the seedlings for a month against flea-beetle [*Phyllotreta* spp.] attack. With the early sowing date, the high rate of γ-BHC applied at 20% of seed-weight doubled the yield compared with the untreated control.—S.M.J.

OTHER

1892 PLESSERS, A. G. and MCGREGOR, W. G. **In search of new oil-producing crops.** *Agric. Inst. Rev.* 1959, **14,** No. 4, 22–4, 59, illus. [Canada Dep. Agric., Ottawa, Ontario]

A review is given of the oil quality and yielding ability of the following potential oil crops recently tested at Ottawa : *Eruca sativa, Crambe abyssinica, Camelina abyssinica, Lepidium sativum, Conringia orientalis, Lallemantia iberica, Guizotia abyssinica, Xanthium strumarium, Cnicus benedictus, Madia* sp., *Nigella damascena, Euphorbia lathyris, Carum carvi* and *Papaver somniferum.*—R.B.

CROP BOTANY

PHYSIOLOGY

1893† KOKETSU, R. **Inner stage of action and eso-ecology of plants.** *Bot. Mag. Tokyo* 1960, **73,** No. 861, 104–6, bibl. 13, Japanese summary. [Kyushu Univ. Fukuoka, Japan]

Eso-ecology is defined as the science which deals with the relationships between physiological functions and environmental conditions in the ' inner stage of action ' (i.e. the internal habitat of a living organism). Possible applications of this concept are outlined.—D.B.

1894 ATAL, C. K. **Microscopic differentiation of cruciferous and non-cruciferous seeds containing mucilage.** *Curr. Sci.* 1960, **29,** No. 2, 56, bibl. 3. [Punjab Univ., India]

The epidermal cells of the seed coat of cruciferous seeds contain mucilage around a central core of cellulose. When observed under crossed Nicols of a polarizing microscope, certain cruciferous seeds (*Lepidium sativum, L. australianum, Brassica juncea, B. napus, B. hirta*) exhibited characteristic polarization crosses. No polarization crosses were observed in mucilaginous seeds of other families, e.g. Plantaginaceae, Linaceae, Labiatae.—D.B.

1895 BURCH, T. A. and DELOUCHE, J. C. **Absorption of water by seeds.** *Proc. Ass. off. Seed Anal. N. Amer.* 1959, **49,** No. 1, 142–50, bibl. 16. [Mississippi Agric. Exp. Sta., State College]

Water absorption studies were carried out with seeds of cotton, soyabeans and oats. Seeds absorbed water more rapidly when immersed in water than when placed on moist blotting paper. Water absorption was more rapid at 30°C than at 20°C. The minimum seed-moisture content to give 50% germination was 52% for cotton, 50% for soyabeans and 34% for oats. The moisture content of seed coats increased during the first 24 hr and remained constant for a further 48 hr, after which there was a slight decrease. Cotyledon and endosperm tissue gained water rapidly for the first 24 hr, then less rapidly. Moisture reached the embryonic axes of cotton seeds within 6–12 hr ; the moisture content of the embryo then increased rapidly until 72 hr after moisture was supplied. Moisture absorption was retarded by the testa in cotton seed and took place over its entire area. F. s. —R.B.

1896 YEN, C. **On a new view of carpel morphology in *Brassica*.** [Chinese] *Acta bot. sinica* 1959, **8,** No. 4, 277, bibl. 4, illus., English summary. [Szechuan Agric. Coll., China]

1897 GARDNER, H. R. and TAYLOR, H. M. **Some effects of elevated atmospheric pressures on growth of wheat plants.** *Agron. J.* 1960, **52,** No. 1, 23–5, bibl. 8, illus. [S.W. Great Plains Field Sta., Bushland, Texas]

Westar wheat was grown from seed for 7 days at 1, 3, 5, 7 or 9 atm. pressure. Pressures of 3 atm. depressed root growth but did not affect shoot growth. Pressures above 3 atm. depressed seedling emergence and growth of roots and shoots. Shoots of seedlings grown under 7 or 9 atm. grew to a height of 3–4 cm, after which growth almost ceased; leaves of these plants were extremely chlorotic.—R.B.

1898 URBAN, Rosemarie. Physiologische Untersuchungen über einige Flavonoide und Oxyzimtsäuren. 2. Untersuchungen über den jahreszeitlichen und tagesperiodischen Verlauf der Stoffbildung. [**Physiological investigations on some flavones and oxycinnamic acids. 2. The seasonal and daily rhythm of metabolism.**] *Planta* 1959, **52,** No. 5, 565–82, bibl. [Univ. Heidelberg, W. Germany]

The seasonal and daily rhythm in the metabolism of phenolic compounds was studied quantitatively in leaves of *Helianthus annuus, Zea mays* and

Triticum vulgare. From results of experiments in darkness it was concluded that there was an endogenous rhythm in the formation of secondary substances and that this rhythm was regulated to a considerable extent by external factors.—D.B.

1899 ARSLAN, N. and BENNET-CLARK, T. A. **Geotropic behaviour of grass nodes.** *J. exp. Bot.* 1960, **11**, No. 31, 1–12, bibl. 13.

1900 AHMAD, R. **The role of transpiration in the absorption and translocation of mineral ions in plants, as measured with radioactive calcium and phosphorus.** *Diss. Abstr.* 1959, **20**, No. 6, 1959. [Ohio State Univ., Columbus]

The experiments reported were carried out on cotton and bean plants.—P.J.B.

1901† MES, Margaretha G. **Influence of temperature on the symbiotic nitrogen fixation of legumes.** *Nature, Lond.* 1959, **184**, No. 4704, 2032–3, bibl. 6. [Res. Inst. Pl. Physiol., Univ. Pretoria]

The author maintains that Meyer and Anderson [*Herb. Abstr.* 29 : 813] imply that their results obtained with *Trifolium subterraneum* (in regard to symbiotic N fixation under high temperatures) may be applicable to all legumes under all conditions. While the author's tests with *Vicia sativa, Pisum sativum* and *Lupinus luteus* confirm the results obtained by Meyer and Anderson, the data from other species which normally grow best during the warmest season or in tropical or sub-tropical areas are quite different ; it is claimed that the influence of temperature on nitrogen assimilation, growth and flowering in leguminous species does not follow any one simple pattern, but should be investigated separately for each species under various conditions.—M.H.

1902† WELTE, E. and WERNER, W. Über die physiologischen Funktionen des Magnesiums in der Pflanze. [**The physiological functions of magnesium in the plant.**] *Landw. Forsch.* 1959, Sonderheft No. 13, 1–9, bibl. 21. [Landw. Forschungsanst. Buntehof, W. Germany]

The role of Mg as enzyme activator is discussed in detail. F. Ger. s.—D.B.

GROWTH

1903 WHEELER, A. W. **Effects of light quality on plant growth.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 74–6.

Kale, sugar-beet, barley and potatoes were grown with 16-hr photoperiods at 20°C under white fluorescent tubes, alone or with different proportions of additional incandescent light. The light intensity of 1450 f.c. at 2 ft below the fluorescent tubes was only slightly increased by the incandescent light, but the total radiation was increased from 6 mW/cm² to 12 mW/cm². After 33 days, dry-matter yields of barley, sugar-beet and potatoes were less where incandescent light was supplied than where it was withheld, while yields of kale were unchanged. Additional incandescent light decreased total leaf area in barley, kale and potatoes, but not in sugar-beet, increased stem extension in potato and kale and decreased shoot and leaf number in barley. In similar tests with *Pisum sativum* and *Vicia faba*, the dry weight and height of dwarf *Vicia faba* were decreased, and those of dwarf peas were increased, by supplementary incandescent light ; tall varieties were unaffected. —S.M.J.

1904† PANKOW, H. and GUTTENBERG, H. VON. Studien über die Anlage der Achselknospen und Blattprimordien bei Gramineen. [**Formation of the axillary bud and leaf primordia in Gramineae.**] *Planta* 1959, **52**, No. 6, 629–43, bibl., illus. [Bot. Inst., Univ. Rostock, E. Germany]

The contribution of the sub-dermatogen to leaf development was studied in *Avena sativa, Sorghum vulgare* and *Triticum vulgare*.—D.B.

GROWTH SUBSTANCES

See also Abs. 1595, 1601, 1640, 1669, 1744, 1792, 1824, 1825, 1864, 1978, 1979.

1905 HUMPHRIES, E. C. and WHEELER, A. W. **Mode of action of gibberellic acid, kinetin and light on leaf expansion.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 74.

1906 HUMPHRIES, E. C. and FRENCH, S. A. W. **Interaction of gibberellic acid and nitrogen supply.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 72–3.

In an investigation of the hypothesis that GA decreases the net assimilation rate of plants because it induces nitrogen deficiency, potato plants were grown in pots with high-N supply and sprayed with aqueous solutions containing 50 ppm GA 2 or 6 times at weekly intervals. Unsprayed controls received additional N, either as ammonium nitrate applied to the soil or as urea applied as a foliar spray twice weekly during the latter part of the growth period. All plots received additional P and K. At first, GA increased the dry weight of the potato tubers, but even the application of N did not sustain the increase. GA increased leaf area, but decreased the net assimilation rate, whether or not additional N was supplied.—S.M.J.

1907 FOTI, S. Su una malformazione dei tuberi in *Solanum tuberosum* L. indotta per via sistemica dalle gibberelline. [**On a deformity in *S.***

***tuberosum* tubers caused by gibberellins through systemic action.**] *Boll. Accad. Gioenia Sci. nat. Catania* 1959, **5,** Ser. 4, No. 5, 296–309, bibl. 62, illus., English, French and German summaries.

1908 HABER, A. H. and LUIPPOLD, Helen J. **Effects of gibberellin on gamma-irradiated wheat.** *Amer. J. Bot.* 1960, **47,** No. 2, 140–4, bibl. 9. [Oak Ridge Nat. Lab., Oak Ridge, Tennessee]

Grain of *Triticum vulgare* var. Thorne given over 612 kr ^{60}Co gamma rays was capable of germinating and growing into small seedlings either in water or in 3×10^{-4} M aqueous GA solution, but no mitosis occurred. GA increased the height and total dry weight of shoots produced by wheat given 1225 kr gamma rays, the response being due to cell expansion alone. It was considered that cell division does not of itself contribute greatly towards increased growth in unirradiated wheat seedlings when treated with GA.—R.B.

1909 WOLF, F. T. and HABER, A. H. **Chlorophyll content of gibberellin-treated wheat seedlings.** *Nature, Lond.* 1960, **186,** No. 4720, 217–8, bibl. 9. [Oak Ridge Nat. Lab., Tennessee]

[See also *Fld Crop Abstr.* 11 : 817.] In tests with wheat seedlings it is shown that chlorosis does not necessarily accompany growth stimulated by gibberellic acid, and the paling in very young seedlings results solely from a failure of chlorophyll synthesis to keep pace with the increased cell expansion. Besides the simple dilution of chlorophyll, the apparent chlorosis in older plants must also result from delayed effects of malnutrition, not from direct action of the acid on formation or destruction of chlorophyll. Stimulation of growth by gibberellic acid without direct effect on chlorophyll metabolism is consistent with the finding that the acid does not directly affect photosynthesis.—M.H.

1910† MES, Margaretha G. **Influence of gibberellic acid and photoperiod on the growth, flowering, nodulation and nitrogen assimilation of *Vicia villosa*.** *Nature, Lond.* 1960, **184,** No. 4704, 2035–6, bibl. 2. [Pl. Physiol. Res. Inst., Univ. Pretoria]

Referring to the works of Thurber *et al.* (*Nature, Lond.* 1958, Vol. 181, p. 1082) and of Fletcher (*Herb. Abstr.* 29 : 814), in which the former reported a decrease in nodulation of dwarf beans treated with GA while the latter found no adverse effects if GA was applied to white clover, the author records experiments which show that the effect of GA on nodulation of *V. villosa* depends on the age of the plants when treated, N assimilation being improved when the chemical was sprayed on plants which were well established under a short photoperiod ; detrimental effects resulted from treatment in the early growth phases.—M.H.

1911 NEUMANN, J. **The nature of the growth-promoting action of coumarin.** *Physiol. Plant.* 1960, **13,** No. 2, 328–41, bibl. 17. [Bot. Dep., Hebrew Univ., Jerusalem]

The effect of coumarin on the growth of *Helianthus annuus, Pisum sativum, Phaseolus vulgaris* hypocotyls and oat coleoptiles was studied. The growth-promoting effect of coumarin at 50 mg/l and IAA at 0·02 mg/l was additive. When the concentration of IAA was 400 mg/l the growth rate of the mixed solution was as great as in coumarin alone. The growth-stimulatory effect of 50 mg coumarin/l was additive to that of IAA up to 2 mg/l, but at concentrations higher than 2 mg/l the additive effect was less evident and approached that produced by 50 mg IAA/l alone. Treatment of the plant material with coumarin prior to IAA treatment resulted in synergistic promotion of growth, but this was not evident when the order of treatments was reversed. Coumarin caused resumption of growth in *H. annuus* hypocotyls which had been in water for 35 hr and whose growth had ceased.—S.M.J.

1912 STENLID, G. **Inhibitory effects of 2-desoxy-D-galactose upon plant roots.** *Physiol. Plant.* 1959, **12,** No. 2, 310–13, bibl. 10. [Pl. Physiol. Inst., Roy. Agric. Coll., Uppsala]

A 10^{-4} M 2-desoxy-D-galactose solution inhibited the growth of roots of flax and wheat by 50%. When glucose was added to the solution, the rate of growth of flax roots was increased. In wheat roots, Cl^- and NO_3^- absorption was inhibited by 10^{-3} M 2-desoxy-D-galactose but a concentration of $3 \cdot 10^{-2}$ M did not affect O_2 uptake. F. S.—S.M.J.

1913 SIRCAR, S. M. and KUNDU, M. **Growth regulating properties of the root extract of water hyacinth (*Eichhornia speciosa* Kunth.)** *Physiol. Plant.* 1960, **13,** No. 1, 56–63, bibl. 12, illus. [Bot. Dep., Univ. Calcutta]

An aqueous extract from healthy roots and shoots of *Eichhornia speciosa* accelerated shoot growth and inhibited root growth of rice, wheat, oats, maize, *Cicer arietinum*, groundnuts and *Brassica campestris*. The extract contained 10 amino acids (listed). The effects on growth produced by the extract were not the same as those produced by IAA or GA.—S.M.J.

1914† NIELSEN, K. F. and others. **The influence of the extract of some crops and soil residues on germination and growth.** *Canad. J. Pl. Sci.* 1960, **40,** No. 1, 188–97, bibl. 19. [Canada Dep. Agric., Ottawa, Ontario]

The effects of aqueous extracts of (a) lucerne hay, (b) timothy hay, (c) maize residues, (d) oat straw, (e) mature potato haulms, and (f) 3 different soils, on the germination and subsequent growth of

lucerne, timothy, oats, soyabeans, maize and peas in sand was investigated at standard germination temperatures. Control samples were germinated in de-ionized water. Extract (a) caused the greatest reduction in percentage germination and length of shoots and roots of all species after 7–10 days, and the greatest delay in germination of all species except timothy. Extract (b) reduced percentage germination and growth to a greater extent than did (c) (d) or (e). Extract (e) had little effect, and soil extracts had practically no effect. Lucerne was affected least by the extracts, timothy most.—R.B.

1915† Brunner, R. Antibiotica in Pflanzenbau und Pflanzenschutz. [**Antibiotics in crop production and plant protection.**] *Bodenkultur* 1959, **10,** No. 4, 293–305, bibl. 40.

This is a review article.—D.B.

1916† Leh, H.-O. Die Wirkung von Streptomycin auf das Wachstum einiger Kulturpflanzen. [**The effect of streptomycin on the growth of some crop plants.**] *Z. Pfl. Ernähr. Düng.* 1960, **88,** No. 2, 129–48, bibl. 4, illus. [Techn. Univ. Berlin]

In small quantities, either in the culture solution, in the soil, or as a spray, streptomycin stimulated growth in length and dry-matter production of *Pisum sativum*, *Vicia villosa* and *Zea mays* and promoted flowering in *P. sativum*. Larger quantities damaged the plants. In large or small quantities, streptomycin was toxic to *Glycine soya* [*G. max*] and *Helianthus annuus*. F. Ger. s.—D.B.

1917 Barbieri, G. Effetti della vitamina B_1 e della vitamina B_6 su piante di pisello, fava, bietola e grano. [**Effects of vitamin B_1 and vitamin B_6 on plants of peas, broad-beans, beet and wheat.**] *Nuovo G. bot. ital.* 1959, **66,** No. 1–2, 14–22, bibl. 2, illus., English summary. [Ist. Bot. Univ. Firenze, Italy]

Trials were carried out to study the effect of applying vitamin B_1 or vitamin B_6, at the rate of 0·01 mg/l of nutritive solution, to plants of *Vicia faba*, *Beta vulgaris*, *Pisum* sp. and *Triticum* sp. grown in pots. The greatest increases in the growth of tops and roots were obtained by treatment with vitamin B_1 on *B. vulgaris*, while the effects on *V. faba* and *Pisum* sp. were less marked. *Triticum* sp. was not affected.—E.B.O.

NUTRITION

1918† Blanchet, R. Comparaison de l'alimentation minérale des plantes dans les solutions nutritives et dans les sols cultivés. [**Comparison of the mineral nutrition of plants in nutrient solutions and in cultivated soils.**] *Année biol.* 1959, **35,** No. 3–4, 127–50, bibl. 47, illus. [Sta. Agron., Châteauroux. Indre. France]

1919† Walker, T. W. **Uptake of ions by plants growing in soil.** *Soil Sci.* 1960, **89,** No. 6, 328–32, bibl. 22. [Univ. Sch. Agric., King's Coll., Newcastle-upon-Tyne]

The subject is reviewed and discussed.—E.B.O.

1920 Löhnis, Marie P. **Effect of magnesium and calcium supply on the uptake of manganese by various crop plants.** *Plant and Soil* 1960, **12,** No. 4, 339–76, bibl. 28, illus. [Landb-Hogesch., Wageningen, Netherlands]

The effect of various levels of Ca and Mg on Mn uptake by plants were investigated in the field and in nutrient cultures. In spring rape (*Brassica napus* var. *napus*), lowering the level of Mg in culture solution slightly increased Mn uptake and Mn toxicity, while lowering the Ca level caused a strong increase. In field experiments with soyabeans, lack of Mg increased Mn uptake and caused severe toxicity on unlimed plots. Adelaar [Eagle] oats, van Hoek's spring wheat, Petkus spring rye and Kenia spring barley absorbed much less Mn than other crops tested. In the field, Mg did not influence the uptake of Mn by cereals, and in culture solution increased Mn uptake only where high Mn concentrations were present in the solution. In flax, Mg did not affect the uptake of Mn, and in the field the injury caused by excess Mn and deficiency of Mg were additive. Uptake of Mn was less at lower levels of Ca. The uptake of Mn by Groenkraag mangels was not affected by either Ca or Mg.—R.B.

1921 Peel, R. D. **Influence of magnesium on growth and development of certain corn [maize] inbreds and soybean varieties in nutrient solution culture and representative Ohio soils.** *Diss. Abstr.* 1959, **20,** No. 6, 1924–7, bibl. 2. [Ohio State Univ., Columbus]

1922 Bedri, A. A. and others. **Assimilation of bicarbonate by roots of different plant species.** *Soil Sci.* 1960, **89,** No. 5, 257–63, bibl. 29. [Univ. California, Los Angeles]

1923 Hale, V. Q. and Wallace, A. **Bicarbonate and phosphorus effects on uptake and distribution in soybeans of iron chelated with ethylene-diamine di *o*-hydroxyphenyl acetate.** *Soil Sci.* 1960, **89,** No. 5, 285–7, bibl. 8. [Univ. California, Los Angeles]

1924 Bhan, K. C. and others. **Possible relationships of bicarbonate or CO_2 assimilation to cation accumulation by plant roots.** *Soil Sci.* 1960, **89,** No. 5, 276–84, bibl. 12. [Univ. California, Los Angeles]

1925 Doney, R. C. **Effects of various levels of bicarbonate, phosphorus, and pH on**

the translocation of foliar-applied iron in plants. *Soil Sci.* 1960, **89**, No. 5, 269–75, bibl. 18. [Utah State Univ., Logan]

1926 Leyden, R. F. and Toth, S. J. **Behavior of zinc sulfate as foliar applications and as soil applications in some New Jersey soils.** *Soil Sci.* 1960, **89**, No. 4, 223–8, bibl. 4. [New Jersey Agric. Exp. Sta., New Brunswick]

The absorption and translocation of ^{65}Zn via foliage and root applications to different plants were studied in sand-solution culture. Foliar applications of $ZnSO_4$ tagged with ^{65}Zn were absorbed and, to some extent, distributed throughout soyabean and maize plants. The amount of ^{65}Zn absorbed through the foliage of soyabeans was considerably less than that absorbed through the roots, whereas maize plants absorbed more ^{65}Zn through the foliage than through the roots. In general, doubling the standard micronutrient level of all elements except Zn, which was kept constant, increased root absorption of ^{65}Zn, but did not influence foliar absorption. F. s.—e.b.o.

1927 Pettersson, S. **Ion absorption in young sunflower plants. 1. Uptake and transport mechanisms for sulphate.** *Physiol. Plant.* 1960, **13**, No. 1, 133–47, bibl. 22. [Inst. Pl. Physiol., Lund]

The uptake of sulphate by 12-day-old sunflower plants from a complete nutrient solution labelled with ^{35}S was measured at 20 and 25°C. During the first 20 min after treatment, there was an initial rapid uptake of ^{35}S both at 20 and 25°C, followed by a slower increase in uptake at a constant rate which depended on the temperature ; after 4 hr the increase ceased. The transpiration intensity did not affect the retention of ions in the roots. The influx coefficient, an expression for the concentration in the transpiration stream of the water-linked component of the ions translocated to the shoot, varied between 0·54 and 0·11, the higher values being obtained at low external concentrations.—s.m.j.

1928 Stephens, D. **Field experiments with trace elements on annual food crops in Ghana.** *Emp. J. exp. Agric.* 1959, **27**, No. 108, 324–32, bibl. 4.

In trials at 10 centres in Ghana to investigate the response of maize, groundnuts, swamp rice, millet and guinea corn to Mn, B, Cu, Mg, Fe, Zn and Mo, the only response was by groundnuts to Mo. Three applications of 0·055% sodium molybdate solution (2·5 lb sodium molybdate/ac) resulted in an average increase of yield significant at the 5% level.—s.m.j.

1929 Sorteberg, A. and Vigerust, E. Markforsøk med molybden. **Field experiments with molybdenum.** *Forskn. Fors. Landbr.* 1960, **11**, No. 1, 31–56, bibl. 16, English summary.

Results are given of 4 field experiments on peatland in Norway in which the effect of Mo applied to a range of crops was investigated. Barley which received Mo yielded 236 kg grain/ha, compared with 133 kg/ha from untreated controls, but the 1000-grain weight increased only from 28 to 31 g. Yields of turnip [*Brassica rapa*] and marrow-stemmed kale [*Brassica oleracea* var. *acephala*] were also increased by the application of Mo. The Mo requirement for these crops was the same whether N was applied as NH_4 or NO_3.—s.m.j.

TECHNIQUES AND APPARATUS

1930† Rogers, I. S. **Dry-conditioned seed has many advantages.** *J. Dep. Agric. S. Aust.* 1960, **63**, No. 9, 393.

Seed which was dried within a few hr in air with a relative humidity of less than 15% and then packed in 1-lb moisture-proof cans or packs, retained its germination 3-4 times longer than did similar seed stored under normal conditions. The packs were insect- and vermin-proof and after they were opened, the seed did not deteriorate any more rapidly than under normal conditions ; it is also claimed that the seedlings produced from dry-conditioned seed are more vigorous.—s.m.j.

1931 Grabe, D. F. **Preliminary evaluation of tetrazolium derivatives for testing seed viability.** *Proc. Ass. off. Seed Anal. N. Amer.* 1959, **49**, No. 1, 122–30, bibl. 9. [Mississippi Agric. Exp. Sta., State College]

Seeds of maize, wheat, rice, soyabeans, red clover, cotton, mustard and turnip were tested at 40°C in 0·1% aqueous solutions of (a) 2,3,5-triphenyl tetrazolium chloride, (b) tetrazolium red, (c) 2-(*p*-iodophenol)-3-(*p*-nitrophenyl)-5-phenyl tetrazolium chloride, (d) tetrazolium violet, (e) 2,2,-(*p*-diphenylene) bis (3,5-diphenyl) tetrazolium chloride, (f) tetrazolium blue. Maize was also tested at 20, 30, 50 and 60°C. Embryos of maize stained most rapidly using (c) and (d), those of cotton with (d), (e) and (f), those of mustard with (d), (c) and (e), and those of soyabeans with (a) and (b). Growth of rice roots was completely inhibited by (a) and (b), and that of mustard roots by (e) and (f). All 6 compounds depressed, but did not prevent, root growth in cotton and soyabeans. All tetrazolium derivatives gave comparable staining reactions in wheat, cotton and rice. Tetrazolium testing overestimated the viability of wheat grain damaged by CH_3Br. In cotton, results with (c) and (f) were difficult to interpret. Stains (e) and (f) alone were not toxic to rice. Seeds of turnip and red clover were all stained by (c), irrespective of viability. Undamaged legume seeds were impermeable to (e) and (f). Stains

(a) and (b) were most satisfactory for soyabeans.—R.B.

1932† STEINKRAUS, K. H. and others. **Gaseous ethylene oxide as a bactericide and fungicide in the treatment of seeds.** *Proc. Ass. off. Seed Anal. N. Amer.* 1959, **49**, No. 1, 159–66, bibl. 8. [New York State Agric. Exp. Sta., Cornell Univ., Geneva]

Seeds of lucerne, peas, Sudan grass [*Sorghum sudanense*], barley, oats, wheat, and maize were treated with ethylene oxide gas for 1, 5, 10, 20, 30 or 60 min at 27°C. Peas, Sudan grass, oats, maize and wheat were freed from mesophilic aerobic bacteria when treated for 30 min or less with pure ethylene oxide. Peas and Sudan grass were uninjured by treatment. Treatment of lucerne seed with 10% ethylene oxide and 90% CO_2 for 12 days at 60°C failed to destroy the microflora. Treatment of barley and oats for 24 hr at 45°C with 10% ethylene oxide killed 99% of the microflora, but reduced percentage germination by over 40%.—R.B.

1933 OXLEY, T. A. and PIXTON, S. W. **Determination of moisture content in cereals.** *J. Sci. Fd Agric.* 1960, **11**, No. 6, 315–9, bibl. 1.

Water added to a soft wheat, whether as vapour (humid atmosphere) or liquid, was accurately assessed by the oven method (heating for 4 hr at 113°C), but water added to a hard wheat by either method was over-assessed proportionately to the amount added. The over-assessment was 1% when the moisture content was increased from 9 to 25% on a dry-weight basis. The amount of water removed from both varieties by drying in a warm current of air was over-assessed, being proportional to the amount of water removed in the hard wheat and inversely proportional in the soft wheats. F. S.—S.M.J.

1934 MATWEEF, M. Méthode rapide de dosage des matières minérales dans le blé et les produits de la mouture. [**Rapid method for determining the mineral substances in wheat and milling products.**] *C.R. Acad. Agric. Fr.* 1960, **46**, No. 6, 285–7, bibl. 2.

1935† BALKS, R. and REEKERS, I. Nitratbestimmung in Pflanzensubstanz mit 1, 2 4-Xylenol. [**Determination of nitrate in plant material using 1, 2, 4-xylenol.**] *Landw. Forsch.* 1960, **13**, No. 2, 134–6, bibl. 5, French and English summaries. [Landwirtschaftskammer Westfalen-Lippe, Münster, W. Germany]

The technique described in *Fld Crop Abstr.* 7 : 1411 gave nitrate determinations which were higher than those obtained by other methods used in the Netherlands and Scandinavia. The differences were greater for young grass than for lucerne. A refined technique is described which includes a preliminary filtration through a column of Al_2O_3 to remove interference by water-soluble carbohydrates. The revised technique uses less time than the earlier one, and results agree with those obtained by the Maastricht method used in the Netherlands.—D.B.

1936 MILLER, M. H. and WERKHOVEN, C. H. E. **An *in-situ* technique for the quantitative determination of fertilizer phosphorus in growing plants.** *Canad. J. Soil Sci.* 1959, **39**, No. 2, 205–14, bibl. 3. [Ontario Agric. Coll., Guelph]

In the method described, plants of maize, sugar-beet and oats sown in pots in a straight row, whose length did not exceed that of the tube of a Geiger-Müller counter, were supplied with fertilizer labelled with ^{32}P and the radioactivity of the plants was measured. The relationship between radioactivity as measured by the counter and the fertilizer-P content of the plants varied with plant height, and regression equations relating these factors are presented. The method can be used to measure the quantity of fertilizer P present in plants without the necessity for harvesting them, but is accurate only while the plants remain vegetative.—R.B.

1937† JENKINS, H. V. **An airflow planimeter for measuring the area of detached leaves.** *Pl. Physiol.* 1959, **34**, No. 5, 532–6, bibl. 4, illus. [Waite Agric. Res. Inst., Univ. Adelaide, S. Australia]

The apparatus described consists of 2 identically perforated plates (625 holes 0·02 in. diameter/sq. in.) mounted on an airtight drum connected to a constant speed rotary exhaust pump. One of the plates, the measuring grid, can be covered by means of a sliding plate whose edge bears a vernier scale. The reduction in air pressure inside the drum is measured by manometric means while the measuring grid is closed. Leaves are then mounted on the specimen grid, and the measuring grid is then opened to adjust the manometer reading to its former value. The exposed area of the measuring grid is then equal to the total surface area of the leaves on the specimen grid and can be read from the vernier scale.—R.B.

1938† SCHUSTER, W. Untersuchungen über die Probeentnahme bei Feldversuchen mit sperrigen Futterpflanzen für Untersuchungen im Labor. [**An investigation into sampling methods in field trials for laboratory analysis of bulky fodder plants.**] *Landw. Forsch.* 1959, **12**, No. 4, 260–70, bibl. 7, English and French summaries. [Inst. f. PflBau u. PflZücht., Univ. Giessen, W. Germany]

The following method is suggested for sampling maize, sunflower and beet tops for chemical analysis. A composite sample is obtained by taking 20–30 adjacent plants from each replicate plot just before the crop is harvested so that the sample and the crop have the same moisture content. If required, the proportions of leaf, stem and ear are determined by separation and weighing, after which the separations are reunited (according to treatment), chopped to 1-cm lengths and thoroughly mixed. Two samples of 1 kg or 4 of 0·5kg are dried immediately and analysed. F. Ger. s.—D.B.

RADIOBIOLOGY

1939 Ito, S. and others. **On absorption and distribution of Sr-90 by lowland rice and wheat plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 160–3, bibl. 5, illus., English summary. [Tokyo Agric. Univ., and Nat. Inst. Health]

Of the total quantity of ^{90}Sr absorbed by rice and wheat plants growing, until reaching the middle stage of spike differentiation, in soils containing labelled Sr, the percentage distribution of ^{90}Sr was : roots, 38·4 ; culm, 41·8 ; spike, 19·8. ^{90}Sr is therefore absorbed to a marked degree in the edible parts of these plants. F. Eng. s.—D.B.

1940 Duckworth, R. B. and Hawthorn, J. **Uptake and distribution of strontium in vegetables and cereals.** *J. Sci. Fd Agric.* 1960, **11**, No. 4, 218–25, bibl. 22, illus. [R. Coll. Sci. Technol., Glasgow]

Wheat was grown in a nutrient solution to which was added 1 ml strontium chloride labelled with ^{89}Sr (1 m.e. Sr/ml) at 2-week intervals. At harvest the leaf and stem contained 73% of the absorbed Sr and the grain 11%. In a 2nd experiment, wheat var. Koga 2, Svenno, Atle and Peko and oats var. Pendek were grown in nutrient solution and given an initial dose of 40 μc ^{89}Sr as $SrCl_2$ (0·04 m.e. Sr), and rice var. Rubibarbis grown in a bucket received 40 and 160 μc ^{89}Sr. Auto-radiographs of the grain showed that the grain surface (which would be removed during milling) contained more ^{89}Sr than did the germ or groat.—S.M.J.

1941† Agricultural Research Council. **Strontium 90 in milk and agricultural materials in the United Kingdom 1958-1959.** *Rep. 2 radiobiol. Lab. A.R.C.* 1960, London, pp. 91, bibl. 13, maps, 5s.

This report is the second of a series dealing with the contamination of human food-stuffs with ^{90}Sr from world-wide fallout [For Rep. 1 see *Fld Crop Abstr.* 13 : 916]. It records the levels in milk, the major source of ^{90}Sr in diet in the UK, during the first half of 1959. It also gives results of surveys of contamination in soil, herbage and animal bones in 1958 as well as an account of experimental studies which assist the interpretation of these results. For the year ending June 1959, the average level of ^{90}Sr in milk was 9·6 $\mu\mu$c per g of Ca. It appears that the 12-month average increased by about 40% between Dec. 1958 and June 1959. The present results support the conclusion that the level of ^{90}Sr in milk is determined mainly by the quantity of fallout deposited in the immediate past and not by the cumulative total in the soil. Information available for samples collected after June 1959 showed a decrease in the values of ^{90}Sr in milk.—E.B.O.

1942† Scheffer, F. and Ludwieg, F. Bestimmung künstlich radioaktiver Isotope der Seltenen Erden in pflanzlichen Futter- und Nahrungsmitteln. [**Determination of artificially induced radioactive isotopes of rare earths in fodder and food from plants.**] *Landw. Forsch.* 1959, **12**, No. 4, 280–9, bibl. 20, English and French summaries. [AgricChem. u. Bodenk. Inst., Univ. Göttingen, W. Germany]

[See also *Fld Crop Abstr.* 12 : 1979.]—D.B.

1943† Norman, A. G. **Applications and problems of radiation and radioisotopes in agriculture.** *Agron. J.* 1959, **51**, No. 12, 702–5.

The subject is discussed under the heads : radioisotopes in agronomic research ; radiation-induced mutants in crop improvement ; fall-out radionuclides in soils and crops.—A.M.H.

1944† Pendleton, R. C. and Uhler, R. L. **Accumulation of caesium-137 by plants grown in simulated pond, wet meadow and irrigated field environments.** *Nature, Lond.* 1960, **185**, No. 4714, 707–8, bibl. 11. [Biol. Op., Hanford Labs, General Elect. Co., Richland, Wash., USA]

In experiments with *Polygonum persicaria*, the ratio of ^{137}Cs uptake by the plants when grown in shallow standing water and in soils saturated and moistened to field-capacity, was 450 : 30 : 1. Since uptake of the element via roots is additive to direct fall-out on to the aerial surfaces of the plants, animals grazing in areas where a major portion of the forage is derived from wet land may ingest >400 times as much ^{137}Cs as those grazing on dry land. [See also *Fld Crop Abstr.* 12 : 902.]—M.H.

MISCELLANEOUS

1945 Czaja, A. T. Die Wirkung von verstäubten Kalk und Zement auf Pflanzen. [**The effects of powdered lime and cement on plants.**] *Qual. Plant. et Materiae veg.* 1960, **7**, No. 2,

184–211, bibl. 13, illus., English summary. [Bot. Inst., Tech. Hochschule Aachen, W. Germany]

Leaves of plants in the neighbourhood of lime and cement works were found to have a surface pH of 8–10·5 when moistened. Moistened leaves of beet [var. not given], dusted with powdered burnt lime or cement and examined after 7 days, displayed shrinkage and irregular distribution of the chloroplasts, while those dusted with ground limestone or precipitated $CaCO_3$ showed irregular distribution of the chloroplasts, but only slight shrinkage. Photosynthesis occurred in leaves treated with limestone or $CaCO_3$ but not in those treated with burnt lime or cement. F. Eng. s.—R.B.

1946† Holliday, R. **Plant population and crop yield.** *Nature, Lond.* 1960, **186,** No. 4718, 22–4, bibl. 5. [Dep. Agric., Univ. Leeds]

When the relationship between crop yield and number of plants per unit area is expressed graphically, there is evidence that the parabolic curve is typical where yield is a product of reproductive growth, while the asymptotic curve is characteristic where yield is a product of vegetative growth. From a study of rape, kale and potatoes, the asymptotic curve has been analysed and equations have been established which, it is maintained, have value for agronomic study of inter-plant competition under certain environments. [See also the review article on pp. 159 and 247.]—M.H.

WEEDS AND WEED CONTROL

Where weeds are specific to a crop, see under the crop concerned. See also Abs. 1913.

1947 Sand, P. F. **A study of some plant characteristics and control of bur ragweed, *Franseria tomentosa* Gray.** *Diss. Abstr.* 1959, **20,** No. 6, 1504–5. [Univ. Nebraska, Lincoln]

Studies are reported on the growth, reproduction, mode of spread, seed germination and carbohydrate status of the root system of bur ragweed. Best control was secured by applying 2 lb 2,4,-D ester/ac in June, with follow-up treatments as required until complete control was achieved.—P.J.B.

1948 Tideman, A. F. **Tomato weed.** *J. Dep. Agric. S. Aust.* 1960, **63,** No. 8, 329–31 and 350.

Tomato weed (*Solanum elaeagnifolium*) is described. It is suggested that it can probably best be controlled by competition from lucerne, or a suitable well-balanced pasture, including *Phalaris*, for the area. The area should be mown when *S. elaeagnifolium* is at the flowering stage. On light soils individual plants may be pulled up and burnt or spot-treated with a solution of 2 lb polybor-chlorate in 1 gal water applied to the plants and to the surrounding soil. $NaClO_3$ can also be used.—S.M.J.

1949 Journal of the Department of Agriculture of South Australia. **Skeleton weed spraying improves crop yields.** *J. Dep. Agric. S. Aust.* 1960, **63,** No. 9, 389.

Trials in the Murray Mallee showed that skeleton weed (*Chondrilla juncea*) competes most strongly with cereal crops during the first 6 weeks of their growth. It is recommended that weed-infested fallows should be sprayed with 0·75 lb 2,4-D (amine) /ac 30–50 days before sowing. During this time the fallows should not be cultivated.—S.M.J.

1950† Journal of the Department of Agriculture of South Australia. **Colocynth —dangerous weed near Mannum.** *J. Dep. Agric. S. Aust.* 1960, **63,** No. 9, 375.

Colocynth [*Colocynthis vulgaris*] has been declared a dangerous weed. Young seedlings can be destroyed by treatment with 2,4-D spray [unspecified), and established plants by burning.—S.M.J.

1951 Hilli, A. Hukkakauran (*Avena fatua* L.) esiintymisestä Suomessa. [**Wild oats (*A. fatua*) in Finland.**] *Suom. Maataloust. Seur. Julk.* 1959, **94,** No. 17, 299–316, bibl. 23, illus. [Govt Seed Control Sta., Helsinki]

Wild oats were not formerly considered to be a serious weed of Finnish crop land, but investigations made in 1957–8 showed them to have spread, especially in Western Finland. An average of 96% of the seed found germinated. Trade in foreign or indigenous seed containing wild oats has been prohibited since Sept. 1957, and the sale of cereal feed containing more than 5 grains of *Avena fatua* per kg is only permitted if it is in the form of finely ground meal. F. Ger. s.—G.M.R.

1952 Phillips, W. M. **The chloro-substituted benzoic acids for control of field bindweed.** *Weeds* 1960, **8,** No. 1, 63–70, bibl. 11, illus. [Fort Hays Branch, Kansas Agric. Exp. Sta., Hays]

TBA, 2,3,6-TBA and PBA (all containing mixtures of chloro-substituted acids and isomers)

were applied at several rates on several dates during 1955–7 to field bindweed (*Convolvulus arvensis*). At 12–17 months after treatment, 15 lb 2,3,6-TBA/ac was equal or superior to 960 lb $NaClO_3$/ac for *C. arvensis* control and was less dependent on rainfall. At a given rate of application 2,3,6-TBA was most effective and PBA least effective. Residues toxic to wheat and sorghum persisted for 2 or more yr. F. s.—s.m.j.

1953 Sripleng, A. and Smith, F. H. **Anatomy of the seed of *Convolvulus arvensis*.** *Amer. J. Bot.* 1960, **47**, No. 5, 386–92, bibl. 20, illus. [Kasetsart Univ., Bangkok, Thailand, and Oregon State Coll., Corvallis]

1954† Gay, P. A. and Berry, L. **The water hyacinth [*Eichhornia crassipes*] : a new problem on the Nile.** *Geogr. J.* 1959, **125**, No. 1, 89–91, bibl. 3, map.

1955† Wiersema, P. Onkruiden in en langs watergangen. [**Weeds in and along waterways.**] *LandbMechanisatie* 1960, **11**, No. 4, 259–63, illus. [Consulentschappen Doetinchem en Hengelo, Netherlands]

Ditches on clay and sandy soil in E. Gelderland containing grasses, reeds [*Phragmites communis*], yellow iris [*Iris pseudacorus*], sedges [*Carex* spp.] and various dicotyledons were cleared of vegetation by spraying with 10–20 kg dalapon plus either 1 kg 2,4-D or 2 kg MCPA in 300–1000 l water/ha. Nettles [*Urtica dioica*] and blackberry [*Rubus* spp.], where present, were controlled with 2,4,5-T at 3–4 l/ha. Various weeds began to germinate 2 or 3 months after treatment. Ditches could be kept clear by an initial application of 10–15 kg dalapon/ha plus growth substances in mid-May and a further 5–10 kg dalapon/ha plus growth substances in Aug. and again in the following June or July. The cost of clearing 1 km of ditch 4 m wide using herbicides was 162 florins during the first year and 68 florins during the second year, compared with 160 florins/yr by hand.—r.b.

1956† Rojas-Garciduenas, M. and Kommedahl, T. **The effect of 2,4-D on germination of pigweed seed.** *Weeds* 1960, **8**, No. 1, 1–5, bibl. 9. [Minnesota Agric. Exp. Sta., St. Paul]

Fifteen days after harvest of seed from pigweed (*Amaranthus retroflexus*) plants sprayed in the field with a sub-lethal dose of 2,4-D (1 lb alkanolamine salt/ac), 11% of the seed germinated while 2% of the seed harvested from unsprayed plants germinated. At 5 months after harvest 50% of the seed from sprayed plants germinated, compared with 10% from unsprayed plants. Germination of scarified seed immersed in 5, 25, 50 and 100 ppm solutions of 2,4-D was not affected after immersion for 1 hr but was almost completely inhibited after immersion for 5, 20 or 30 hr. F. s.—s.m.j.

1957† Rochecouste, E. and Vaughan, R. E. **Weeds of Mauritius. *Bidens pilosa* Linn. (Herbe Villebague). *Cassia occidentalis* Linn. (Casse-puante). *Oxalis latifolia* H.B.K. (Trèfle, Oseille), *O. debilis* Kunth. (Trèfle, Oseille) and *O. repens* Thunb. (Petit Trèfle, Petite Oseille).** *Leafl. 1, 2 and 3 Sug. Industr. Res. Inst. Mauritius* 1959, pp. 4+4+7, bibl. 2, illus.

These leaflets give botanical descriptions, notes on ecology and control measures for common weeds of Mauritius. [See also *Fld Crop Abstr.* 13 : 937.]—e.b.o.

1958† University of Nottingham. [**Dormancy of charlock (*Sinapis arvensis*).**] *Rep. Nottingham Univ. Sch. Agric. 1959*, 1960, 21.

1959† Derscheid, L. A. and Schultz, R. E. **Achene development of Canada thistle and perennial sowthistle.** *Weeds* 1960, **8**, No. 1, 55–62, bibl. 12. [South Dakota State Coll., College Station]

At 9 days after flowering 86% of perennial sowthistle (*Sonchus uliginosus*) achenes were viable, and 95% of Canada thistle (*Cirsium arvense*) achenes were viable at 11 days after flowering. For *S. uliginosus* mowing to prevent seed production should take place within 8 or 9 days after the flower-heads open and within 10 or 11 days for *C. arvense*.—s.m.j.

1960† Thurston, Joan M. **Other weed species.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 82–3.

Seedlings of *Chenopodium album* can be distinguished from those of *Atriplex patula* at germination, when the backs of the cotyledons at emergence are mauve and green, respectively. Seed of *A. patula* germinated only in April and May, but *C. album* germinated throughout the summer until August. Only 40% of seeds of *A. patula* and 65% of *C. album* germinated in the 1st yr.—s.m.j.

1961† Roux, J. Contribution à l'étude de l'*Imperata cylindrica* (L.) P.B. [**Contribution to the study of *I. cylindrica*.**] *Bull. Soc. bot. Fr.* 1958, **105**, No. 7–8, 337, bibl. 4. [Seen June, 1960]

The *Imperata cylindrica* varieties *major* from Malaya, *europaea* from Morocco and southern France, and *africana* from the Abidjan region (Ivory Coast) were found to have different chromosome numbers.—e.b.o.

1962 Bakshi, T. S. and Coupland, R. T. **Vegetative propagation in *Linaria vulgaris*.**

Canad. J. Bot. 1960, **38,** No. 2, 243–9, bibl. 19, illus. [Univ. Saskatchewan, Saskatoon]

1963† Shimizu, M. **Relation of the enclosing structure of the *Digitaria adscendens* spikelet to its germination. 2. The role of the enclosing structure (glumes and shell coat) of crab grass (*D. adscendens*) and rice-plant spikelets in the absorption of water and water soluble substances.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28,** No. 2, 239–43, bibl. 11, illus., English summary. [Kyushu Univ.]

The rate of entry of water into the embryo of *D. adscendens* [*D. sanguinalis*] when seeds were in the non-dormant and dormant condition, the path of entry as revealed by staining, and the effect of glumes and other coverings in preventing entry of water into the embryo are described and illustrated. The functions of the spikelet in controlling dormancy by first preventing water from reaching the embryo and later encouraging germination by facilitating entry of water are discussed. The entry of water into rice caryopsides was studied by means of solutions containing ^{32}P. F. Eng. s.—D.B.

1964 Joglekar, R. G. and others. **A short note on the control of weed Striga.** *Indian J. Agron.* 1959, **4,** No. 2, 114–17, bibl. 5. [Agric. Res. Inst., Nagpur]

Fernoxone and dicotox, the Na salt and ethyl ester of 2,4-D, respectively, each sprayed at 1·0 lb and 1·5 lb a.e. per acre when *Striga euphrasioides* was 7–9 in. tall, were effective against this weed. Of the two, less of the ethyl ester was required and it acted more rapidly. The above herbicides, the amine salt of 2,4-D, and the Na salt of MCPA retained their toxicity in the soil for about 2 months, killing plants of *S. lutea* which emerged after treatment.—D.B.

1965 Sunderland, N. **The production of the *Striga* and *Orobanche* germination stimulants by maize roots. 1. The number and variety of stimulants.** *J. exp. Bot.* 1960, **11,** No. 32, 236–45, bibl. 9. [John Innes Hort. Inst., Bayfordbury, Hertford, Herts]

By means of paper partition chromatography and a suitable biological test, the number and variety of the *Orobanche* and *Striga* germination stimulants produced by maize roots have been assessed. It is shown that extracts of maize roots and aqueous solutions in which roots have been suspended (diffusate solutions) contain a complex of stimulating substances consisting of, at least, one water-soluble and a number of ether-soluble stimulants. Germination of *O. minor* is promoted by the water-soluble stimulant and one of the ether-soluble stimulants (M_o). Germination of *S. hermonthica* is promoted by another ether-soluble stimulant (M_s). Aqueous extracts are rich in M_s and the water-soluble material, whereas the diffusate contains a higher proportion of M_o and only a trace of the water-soluble stimulant. The complex of ether-soluble stimulants, but not the water-soluble stimulant, accumulates in a solution of glucose when it is exposed to fragments of maize roots. These solutions contain a high proportion of M_o which is synthesized by the fragments and passes out into the sugar solution. It is suggested that the water-soluble stimulant is a precursor of M_o. The effects of the water-soluble stimulant and of M_s and M_o are greatly enhanced if a trace of the diffusate solution from linseed roots is mixed with them. The significance of the enhancement is discussed. F. s.—M.H.

1966† Ivens, G. W. **The effects of arboricides on East African trees and shrubs. 4. *Tarchonanthus camphoratus* L. and *Euclea divinorum* Hiern.** *Trop. Agric.* 1960, **37,** No. 2, 143–52, bibl. 4. [Colonial Pesticides Res. Unit, Arusha, Tanganyika]

The effect of spray applications of 2,4,5-T and 2,4-D to previously uncut *Tarchonanthus camphoratus* and *Euclea divinorum* were compared with the application of a 40% sodium arsenite paste to trees ring-barked at ground level. Concentrations of 1·25% or 2·5% a.e. 2,4,5-T applied to *T. camphoratus* after preliminary frilling gave a high degree of kill; follow-up applications of 0·5% a.e. 2,4,5-T killed regenerated growth. Applications of 2·5% a.e. 2,4-D, with 0·5% 2,4-D as follow-up treatments, were equally effective. Sodium arsenite killed all the trees treated, but did not prevent regeneration. The application of monuron sprayed on the ground in a ring round the tree at 18 g a.e./tree (8 lb/ac) resulted in a 60% total and 20% partial kill after 12 months, but no regeneration occurred. Mature *E. divinorum* was only slowly affected by 2,4,5-T or 2,4-D and at least 50% regeneration occurred.—S.M.J.

1967† Bumpus, E. D. **Bush control trials.** *Rep. Dep. Agric. Kenya 1958* 1960, 90–1.

The Holt Weedbreaker was used on plots of *Acacia drepanolobium* as follows: large trees were treated in March, medium-sized trees in July and small trees in Sept. The greatest kill was obtained with medium-sized trees. Regrowth occurred in most cases at or below ground level, but died back on March-treated plots. A heavy chain pulled across 50 ac of *A. drepanolobium* produced similar results to the weedbreaker. 2,4,5-T and MCPB, each applied as 1·25% aqueous solutions and 2,4,5-T in diesel oil were applied to (a) stumps of *Euclea divinorum* following slashing; (b) as a foliar spray and (c) as a basal spray. 2,4,5-T used as a foliar spray in either oil or water produced complete defoliation, die-back on the secondary

branches and complete kill of top growth on 20% of treated trees. Treatment (c), using 2,4,5-T, resulted in a 50% kill and weakened regrowth of the remaining trees ; 2,4,5-T applied to the basal 2 ft of the trees showed evidence of being the most effective treatment of all.—S.M.J.

1968 STRYCKERS, J. Totale vernietiging van vegetatie. **Total destruction of vegetation.** *Meded. LandbHogesch. Gent* 1959, **24,** Nos 3–4, 864–80, bibl. 9, English, French and German summaries.

Experiments on total destruction of vegetation were carried out on land supporting a stand of *Lolium perenne, Holcus lanatus, Agrostis stolonifera, Agropyron repens, Festuca rubra, Poa trivialis, P. annua, Dactylis glomerata, Carex stolonifera, Medicago sativa, M. lupulina, Melilotus alba, Trifolium repens, Cirsium arvense, Ranunculus repens, Taraxacum officinale, Hypochoeris radicata, Hieracium pilosella, Plantago major, P. lanceolata, Rumex crispus, R. acetosa, Polygonum aviculare, Chrysanthemum leucanthemum, Equisetum arvense, Achillea millefolium, Sonchus arvensis, Potentilla anserina, Tussilago farfara, Tanacetum vulgare, Artemisia vulgaris, Glechoma hederacea, Heracleum sphondylium, Senecio vulgaris, Daucus carota, Rubus fruticosus* and *Sarothamnus scoparius.* The initial and residual effects on this community of simazin, trietazin, propazin, fenuron, monuron, diuron, neburon, amitrol, $NaClO_3$, NH_4 sulphamate, dalapon, TCA, erbon and borax anhydride at various rates, alone or in mixtures, are described. Best control of vegetation was obtained following spring applications of herbicides. Applications in autumn immediately following mowing were also effective. —R.B.

1969 BLEASDALE, J. K. A. and ROBERTS, H. A. **The effects of different methods of seed-bed preparation on weed emergence.** *Rep. nat. veg. Res. Sta., Warwick 1959* Wellesbourne, 1960, 46–9, bibl. 3.

Four field experiments were carried out to determine the effects on weed emergence of 3 degrees of fineness of tilth, with and without rolling. Weed numbers increased with increasing fineness of tilth and were greater on plots that had been rolled. Some implications of these results are discussed. F. s.—S.M.J.

1970† PODOPRIGORA, V. S. [**Viability of seeds of late spring weeds in the steppe soil of the Ukrainian SSR.**] [Russian] *Bot. Ž., SSSR (Bot. J., USSR)* 1960, **45,** No. 2, 272–6, bibl. 11. [All-Union Sci. Res. Inst. for Maize, Dnepropetrovsk]

At the Erastov Experimental Station of the above Institute, a soil study showed that the ploughed layer (0–35 cm) contained an average of 163–397 million weed seeds per ha, of which the greater part (80–94%) comprised late spring weeds, e.g. *Chenopodium album, Amaranthus albus, Polycnemum arvense, Setaria glauca* and *S. viridis.* The seeds retain their viability for 6 or more years and constitute a potential source of infestation for all sown crops. There is evidence that seeds in the 0–10 cm soil horizon perish sooner than those at 20 cm where aeration and warmth are less.—M.H.

1971† PODOPRIGORA, V. S. **Viability of seeds of late spring weeds in water.** [Ukrainian] *Ukr. bot. Ž., Kiev (Ukrainian Bot. J.)* 1959, **16,** No. 6, 23–9, bibl. 6, English summary. [All-Union Sci. Res. Inst. Maize, Dnepropetrovsk]

An experimental study of the effect of submersion in water on viability of the seed of late-spring weeds widespread in the Ukraine is reported. The submersion period ranged from 22 days to 13 months. Seeds of *Echinochloa crus-galli, Setaria viridis, S. glauca, Chenopodium album* and *Amaranthus albus* retain their viability in water for more than 13 months, although their germinating capacity is reduced, varying from 3% (*E. crus-galli*) to 27% (*Ch. album*). Seeds of *Salsola ruthenica* lose their germinating capacity after 22 days in water. The germination capacity of all seeds in tap water is higher (41–50%) than in boiled water (19%). This is attributed to the fact that boiled water does not contain [available] oxygen. F.s.—M.H.

1972† WILSON, F. **A review of the biological control of insects and weeds in Australia and Australian New Guinea.** *Tech. Comm. 1. Commonw. Inst. biol. Contr.* 1960, pp. 102, bibl. 558.

A review is given of the biological control of *Pieris rapae, Plutella maculipennis, Brevicoryne brassicae, Hippotion celerio, Smynthurus viridis, Opuntia* spp., *Hypericum perforatum, Lantana camara* and *Eupatorium adenophorum.*—R.B.

1973† WELBANK, P. J. **Competition between crop and weeds.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 84.

Kale and wheat plants were grown in pots alone or with *Chenopodium album, Polygonum aviculare, P. persicaria* or *Atriplex patula.* Two rates of N [not specified] were applied. At the lower rate of N, the weeds reduced leaf area and dry weight by 40% in both kale and wheat. At the higher rate of N weeds had less effect on kale than at the lower rate of N, but reduced the leaf area and weight of wheat by 60%. When grown with *C. album* the dry weight of the stems of wheat was decreased more than the leaf weight at the high rate of N. Competition with kale decreased the weights of weeds more than competition with wheat and the effects of the crops on weeds were similar at both rates of N supply.

Sugar-beet seedlings were transplanted into pots and either grown alone or with *Agropyron repens* at all combinations of 3 rates each of N and K. At harvest, 2 weeks later, the relative growth rate of the sugar-beet was increased by N and K and decreased by competition with *A. repens*. The mean response to N but not to K, and the effects of N but not of K on relative leaf growth rate and on percentage dry matter of leaves, stems and roots in sugar-beet were greater with competition than without. Competition with *A. repens* decreased uptake of N and K by sugar-beet at all rates but to the greatest extent at the lowest rates of nutrient supply. When germinated rape seed was placed in an extract from the roots and rhizomes of *A. repens*, radicle elongation was halved by the root extracts and decreased by two-thirds by rhizome extracts ; hypocotyls were less effected. The extracts were more toxic after 22 days than after 15 days incubation. —S.M.J.

1974† TIDEMAN, A. F. **The Weeds Act.** *J. Dep. Agric. S. Aust.* 1960, **63**, No. 9, 376–80.

The S. Australian Weeds Act of 1956 is explained. The following are listed as dangerous weeds ; their common names are also given : *Alternanthera repens, Cirsium arvense, Colocynthis vulgaris, Eichhornia crassipes, Euphorbia marginata, Iva axillaris, Rhus radicans, Salpichroa rhomboides, Salvia reflexa, Senecio jacobaea, Sida leprosa* var. *hederacea* and *Xanthium pungens*. 41 species are proclaimed as noxious weeds for the whole of S. Australia and a further 8 for particular parts of S. Australia.—S.M.J.

1975 KASAHARA, Y. **Studies of the kinds of the weeds of arable land in Japan and their geographical distributions. 6. The origin and history of Japanese weeds.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 2, 244–6, bibl. 13, English summary. [Ohara Inst. Agric. Biol., Okayama Univ.]

The weed species of arable land in Japan have been classified in 5 groups : (1) recently naturalized weeds on upland fields ; (2) old naturalized weeds; (3) species of old world origin ; (4) prehistoric naturalized species ; (5) Japanese native species. Groups 1 and 2 are further subdivided according to region of origin. Species in group 4 are from S.E. Asia and are the weeds of rice fields. Most of the troublesome weeds are of foreign origin. F. Eng. S.—D.B.

1976† SOIL AND CROP SCIENCE SOCIETY OF FLORIDA. **Symposium : weed control.** *Proc. Soil Crop Sci. Soc. Fla* 1958, **18**, 203–27, bibl. to indiv. papers. [Received Dec., 1959]

The symposium included short reviews on the following subjects : Weed control — a continuing challenge, by E. W. Hauser ; Aquatic weed control, by D. E. Seaman ; Weed control in lawns and ornamentals, by R. W. White, Jr ; Brush control, by E. G. Rodgers ; Weed control in Florida field crops (groundnuts, maize, soybeans, oats and pastures), by E. O. Burt.—A.M.H.

1977† FREED, V. H. **Some biochemical and physical considerations relating the structure to plant growth regulating activity of N-aryl carbamates, substituted ureas and chlorophenoxyacetic acids.** *Diss. Abstr.* 1959, **20**, No. 6, 1562–3. [Univ. Oregon]

The results are given of studies on the relationship between structure and activity and mode of action of mono-, di- and tri-substituted chlorophenoxyacetic acids, O-alkyl N-aryl carbamates and 3-aryl 1-alkyl substituted ureas.—P.J.B.

1978† CORNS, W. G. **Effects of gibberellin treatments on germination of various species of weed seeds.** *Canad. J. Pl. Sci.* 1960, **40**, No. 1, 47–51, bibl. 6. [Univ. Alberta, Edmonton]

Seeds of *Avena fatua, Sinapis arvensis, Thlaspi arvense, Lappula echinata* and *Galeopsis tetrahit* were soaked in aqueous 500 or 1000 ppm a.e. K gibberellate for 24 hr or 7–10 days at various intervals after collection. GA broke dormancy in *S. arvensis* and *T. arvense* and to a small extent in *L. echinata* and *G. tetrahit*. Germination of *A. fatua* was considerably increased by GA in some seed samples, while others remained completely dormant. GA had no effect on the percentage germination of seeds of 14 other species of weeds.—R.B.

1979† THURSTON, Joan M. **Weed studies. The effect of gibberellic acid on the germination of wild oats.** *Rep. Rothamsted Exp. Sta. 1959* Harpenden, 1960, 82.

Seeds of *Avena ludoviciana* were soaked in tapwater for 24 hr at room temperature, with or without pricking of the seed coats, or in gibberellic acid solution (50 ppm), before being germinated in incubators at different temperatures. At 7°C, 95% or more of the seeds germinated, irrespective of treatment, but at higher temperatures more pricked than unpricked seeds germinated and GA treatment was almost as effective as pricking in breaking temperature-induced dormancy; at 27°C, only 10% of unpricked seeds germinated, whereas pricking or treatment with GA gave 50% germination. GA was less effective when the seeds were soaked for less than 20 hr. Solutions of 25 ppm were as effective as 50 ppm, but concentrations below 25 ppm had less effect.—S.M.J.

1980 HERRETT, R. A. **Studies on the absorption, translocation and metabolism of**

3-amino-1,2,4,-triazole in perennial plants. *Diss. Abstr.* 1959, **20**, No. 6, 2002. [Univ. Minnesota, Minneapolis]

The studies reported were carried out with *Cirsium arvense* and *Convolvulus arvensis*. The rate of absorption and metabolism of amitrol was much greater in *C. arvense* than *C. arvensis*, and these differences were considered to be the major cause of the relative susceptibility of the 2 species to this herbicide.—P.J.B.

1981† Koopman, H. and Daams, J. **2,6-dichlorobenzonitrile : a new herbicide.** *Nature, Lond.* 1960, **186**, No. 4718, 89–90, illus. [Chem. Res. Lab., N.V. Philips-Duphar, Weesp, Holland]

This chemical (code name H133) is active against many weeds, including wild oats, bracken, chickweed and cleavers. Traces of the compound inhibit seed germination, concentrations as low as 5×10^{-5} mg/ml being effective in preventing millet seed from germinating. This is about a hundred times less than the concentration of the herbicide propham needed to produce the same effect. H133 stunts or kills young plants but does not damage those older or fully grown. It appears to act through both plant roots and foliage. Its acute toxicity for warm-blooded animals is low. Preliminary laboratory test results are reported.—From *New Scientist*, 14 April, 1960.

1982 Ameen, O. A. and others. **Effect of 1,2,4,5-tetrachlorobenzene on the germination and seedling vigor of barley, oats and wheat.** *Agron. J.* 1960, **52**, No. 2, 87–9, bibl. 8. [Arizona Agric. Exp. Sta., Tucson]

In glasshouse trials, Arivat barley, Palestine oats and Ramona 50 wheat germinated in clay soil treated the previous day with 15 lb or less 1, 2, 4, 5-tetrachlorobenzene (TCB)/ac, but not in similarly treated sandy loam, clay loam or sandy soil. Phytotoxicity of TCB decreased as sowing date was delayed. TCB at up to 135 lb/ac was no longer toxic to cereals 125 days after treatment [see *Fld Crop Abstr.* 11 : 1093 and 11 : 1249].—R.B.

SURVEYS AND LAND USE

SURVEYS

1983† Collin-Delavaud, C. Khoadja Qendu. Mise en valeur d'un piémont dans le Turkestan afghan. Province de Maïmana. [**Khoadja Qendu. Improvement of a piedmont district in the Turkestan of Afghanistan. Province of Maimana.**] *Ann. Géogr.* 1960, **69**, No. 372, 135–56, bibl. 2, illus.

Information is given on agriculture, irrigation and the pastoral industry in that district.—E.B.O.

1984 Koninklijk Instituut voor de Tropen. Kambodja aan het begin van het vijfjarenplan. [**Cambodia at the beginning of the five-year plan.**] *Tijdschr. econ. soc. Geogr.* 1960, **51**, No. 1, 18–20, English summary.

Rice occupies about 80% of the cultivated area of Cambodia. Maize is the most widely grown of the subsidiary crops ; a white variety is grown for home consumption and a red variety for export. The importance of crops in descending order is : rice, maize, soyabeans, groundnuts, sesame and cotton.—R.B.

1985 New Zealand, Department of Scientific and Industrial Research. **Soils and agriculture of part Geraldine County New Zealand.** *Soil Bureau Bull. 13*, D.S.I.R., N.Z., 1959, pp. 65, bibl. 24, illus., maps, 17s. 6d.

1986 Mitchell, C. W. **Investigations into the soils and agriculture of the lower Diyāla area of eastern Iraq.** *Geogr. J.* 1959, **125**, No. 3–4, 390–7, bibl. 19, illus.

LAND USE

1987† Allan, W. **Changing patterns of African land use.** *J. R. Soc. Arts* 1960, **108**, No. 5048, 612–29, bibl. 6, illus.

1988† Friedrich, J. Das Donaumoos und seine Landwirtschaft in Gegenwart und Zukunft. [**The Donau [peat] moss, its agriculture at the present time and in the future.**] *Bayer. landw. Jahrb.* 1959, **36**, No. 6, 695–729, bibl. 15, illus. [Landesanst. f. Landkultur u. Moorwirtschaft, München, W. Germany]

An illustrated account is given of the agricultural history of this area and improvements which have taken place in its agricultural and economic status. Measures introduced by the Bayerische Landesanstalt für Moorwirtschaft und Landkultur include : the provision of windbreaks ; the control of peat removal ; the replacement of continuous potato cultivation with a crop rotation consisting of potatoes, sugar-beet, cereals, clover/grass ley, and arable fodder crops. In addition to the bibliography there is an appendix of literature concerning the Donau moss from 1781 to 1955.—D.B.

FARMING SYSTEMS AND PRACTICES

1989 Muhamedgaliev, F. M. [**Systems of agriculture in Kazahstan.**] [Russian] *Zemledelie* (*Agriculture, USSR*) 1960, **8**, No. 2, 14–19. [Kazah Acad. Agric. Sci.]

1990 Hopfen, H. J. **Tillage and ploughs in dryland farming areas.** *Features Sect. Publ. FAO* 1960, pp. 3, illus.

1991† Steikhardt, H. Bericht über die Ergebnisse der Stoppelfruchtversuche 1954/57. [**Report on the results of stubble-crop trials.**] *Z. landw. Vers- u. UntersuchWes.*, 1959, **5**, No. 2, 190–204, English and Russian summaries. [D. A. L., Jena, E. Germany]

A tabulated account is given of yields (green weight, dry weight and protein) of sunflower, field peas, sunflower/legume mixture, maize, millet, mustard, stubble turnip, cabbage, lupin and serradella, sown as stubble crops on 7 dates in July and August, in different soils, climates and altitudes.—D.B.

1992 Laird, R. J. and others. Manejo de los residuos de las cosechas en una rotación de maíz y trigo en El Bajío. [**Management of crop residues in a maize/wheat rotation in El Bajío (Mexico).**] *Fol. téc. 37 Sec. Agric. Ganad., México* 1959, pp. 23, bibl. 31, illus., English summary. [Exp. Sta. La Cal Grande, La Piedad, Michoacán]

A common rotation in irrigated areas in El Bajío (dry winters and wet summers) is maize in summer and wheat in winter. Investigations were carried out in 1953–8 to determine the effect of burning the wheat straw and removing the maize stalks on subsequent crop yields. Maize and wheat yields were 10–20% higher, and weed infestation was lower, following the burning or removal of crop residues than following their incorporation into the soil.—E.B.O.

1993† Molenaar, A. **Irrigation by sprinkling.** *Agric. Develop. Pap. 65 FAO* 1960, pp. 93, bibl. 10, illus.

This publication is one of a proposed series designed to aid in the better use and control of irrigation water. Its purpose is to provide information and to serve as a textbook. The first part is largely informative while the second describes the procedure for the design of sprinkler systems.—E.B.O.

1994 Munro, J. M. [**Irrigation of field crops in Nyasaland.**] *Progr. Reps Exp. Stas Emp. Cott. Gr. Corp., Nyasald Protect. 1958-9* 1960, 9–12. [Makanga, Nyasald]

Cotton did not benefit from supplementary irrigation applied during the growing season, but where the preceding crop had received irrigation during the dry season, cotton yields were increased. Total yields of over 2000 lb seed cotton/ac were obtained,whether or not the cotton received irrigation, compared with 700–1600 lb/ac where cotton followed a dry-season fallow. Cotton had an irrigation factor (I.F.) of 0·5 (the ratio of irrigation water used to the evaporimeter reading for the same period of time). Maize had an I.F. of 0·6 at tasseling (10 weeks after sowing). During the 10th to the 14th week of growth, a factor of 1·6 or more was required. Lucerne had an I.F. of 1·0–1·2, wheat of 0·6 or less. At the higher irrigation rates, *Panicum maximum* appeared above the wheat just after the flowering of the wheat and competed with it. Groundnuts had an I.F. of 0·8.—S.M.J.

1995† Rebour, M. Étude comparative de la valeur d'utilisation des eaux d'irrigation douces et salées. [**Comparative study of the value of fresh water and saline water for irrigation.**] *C.R. Acad. Agric. Fr. 1960*, **46**, No. 4, 175–82, bibl. 6, illus.

1996 Durand, J. H. **The quality of irrigation water.** *Sols afr.* [n.d.], **4**, No. 3, 52–88, bibl. 12, text in English and French. [Received Nov., 1959]

This article is concerned with the problem of salinity in irrigation water with reference to Algeria.—E.B.O.

1997 Hénin, S. and Fraigneaud. Quelques considérations sur le problème des assolements. [**Some considerations on the problem of crop rotations.**] *C.R. Acad. Agric. Fr.* 1960, **46**, No. 9, 519–26.

While farming in France was based in the past on rotations of crops, there has been a trend in recent times to abandon this practice and to grow by mechanized methods a very small number of crops well adapted to a given region. The question has, however, arisen whether, in spite of recent technical advances, there is still an advantage in growing a succession of crops. For a 60-ha farm near Paris the following rotation, which takes into account compatibility among crops and profitability, has been chosen : potatoes/wheat/peas/wheat/barley, each grown on 12 ha.—E.B.O.

1998 Koblet, R. and Wehrli, A. Über die Struktur von Ackerböden beim Anbau von

Kleegras. [**The structure of arable soils under clover/grass mixtures.**] *Z. Acker- u. PflBau* 1959, **109**, No. 4, 337-54, bibl. 25, English summary. [Inst. PflBau, Eidg. Techn. Hochsch., Zürich, Switzerland]

Aggregate stability was higher under grass than under legume 5 months after establishment of the ley, and stability increased with an increasing proportion of grass in grass-clover mixtures. Plant roots affected porosity only by their effect on pores of >0·02 mm diameter. The residual effect of leys did not last longer than 1 year following plough-up, though soil under grass maintained higher air- and field-capacities than did soil under legume or fallow. The aggregate stability remained higher under winter rye and barley sown as catch crops than under fallow ; it was markedly higher in soils of >35% clay content but depended mainly on the organic-matter status, soil management and kind of crop in soils containing less clay. Optimum air capacities for grasses (5–10%) in 3-year-old leys were reached or surpassed when moisture tension increased from 2 cm (saturation) to 50 cm or more up to field capacity. From *Soils and Ferts.* 23 : 635. [See also *Herb. Abstr.* 30: 25.]—D.B.

1999 Sahasrabudhe, V. B. and Khargonkar, S. A. **Crop yields and economic aspects of three and four course rotation in Malwa.** *Indian Cott. Gr. Rev.* 1959, **13**, No. 6, 466–8, bibl. 2. [Inst. Pl. Ind., Indore]

The 3-course rotation, the one formerly practised, was sorghum/cotton/wheat. The new 4-course rotation is sorghum/groundnuts/cotton/wheat. The yields and economic returns obtained from these cropping systems were investigated from 1948 to 1957. The yield of cotton was approximately the same from each system. Profits were higher from the 4-course than from the 3-course rotation because of the high market value of groundnuts in the former. Yields of food crops, however, were better in the 3-course rotation. For example, the yield of wheat grain was, on average, 56 lb/ac higher (significant) and of grain sorghum 22 lb/ac higher (non-significant.)—D.B.

2000† Vorob'ev, S. A. and Krupenina, A. P. [**Catch crops—a supplementary reserve for augmenting crop harvests.**] [Russian] *Izv. Timirjazevsk. S-H. Akad.* (*Bull. Timirjazev agric. Acad.*) 1959, No. 6 (31), 45–56, bibl. 8.

Following an account of the use of catch crops in various countries, the authors' experiments (1957–8) at the Vladimir Experimental Station with various species are described. On an area of 480 sq.m, the following were sown in spring under rye (4 replications) : *Trifolium pratense* (at 16 kg/ha), *Melilotus alba* (12 kg), and *Lupinus polyphyllus* (60 kg) ; after the rye grain harvest, *Pisum sativum*, winter rape, vetch/oat mixture, fodder lupin, and *Sinapis alba* were sown separately (10 Aug.) on the stubble, at 15–20% above the usual norm. The effect of various crops on soil organic residues, soil moisture, soil N and P are discussed in the light of results from other investigators. It is concluded that, of the catch crops, the best are *Lupinus polyphyllus*, *M. alba*, *P. sativum* and *S. alba*. The two last species require a heat sum total of 750–850°C in order to flower. In the north-west, west, central and southern regions of the non-chernozem belt, the total temperature in the period following harvest of the grain crop reaches an average of 800°C, the duration of the post-harvest period before the onset of frost is 65–75 days, and precipitation is, on the average, above 100 mm. The conditions are therefore favourable for growing catch crops.—M.H.

2001† Tjulin, V. V. [**Insistence on the sowing of fallows in north-eastern regions** (**of European USSR**).] [Russian] *Zemledelie* (*Agriculture, USSR*) 1960, **8**, No. 2, 28–32.

Data obtained from the Kirov Agricultural Institute, the Udmurt and Mari Experimental Stations and from trials in the Kostroma Province are quoted in support of the view that the sowing of vetch/oat or pea/oat mixtures, or clover, or early potatoes on the fallow preceding the sowing of the grain crop (winter rye) enhances the yield potential of the sown area. During 1957–8, for example, the total yield of rye sown : (a) on a bare fallow was 2600 kg/ha ; (b) on an area from which a vetch/oat mixture had been harvested, 2200 kg/ha. The total fodder units obtained, however, were 3120 kg/ha from (a) and 6640 from (b).—M.H.

2002† Jamison, V. C. and Thornton, J. F. **Results of deep fertilization and subsoiling on a claypan soil.** *Agron. J.* 1960, **52**, No. 4, 193–5, bibl. 7. [Missouri Agric. Exp. Sta., Columbia]

Ploughing 9–10 in. deep, followed by tillage of the exposed subsoil to an additional depth of 7–8 in. on silt loam soil in 1947 or 1949, reduced yields of maize, wheat and soyabeans in 1948–53 compared with ploughing alone. Lime at 4 tons/ac plus rock phosphate at 1 ton/ac applied to the subsoil overcame the adverse effects of subsoil tillage, improved growth and rooting of sweet clover [*Melilotus* sp.] and increased lucerne yields up to 10 years after treatment. In further trials in 1954, lime at 8 tons/ac, with or without triple superphosphate (45% P_2O_5) at 400 lb/ac mixed with the lime, was applied (a) in the bottom of the furrow, (b) as 6 tons lime/ac mixed with the subsoil 12 in. deep and 2 tons lime/ac disc-harrowed into the surface soil, (c) 20 in. deep using subsoil

tillage, or (d) 30 in. deep using subsoil tillage. Treatments (b), (c) and (d) increased average maize yields during 1955–8 to a small but significant extent. Compared with lime alone, P reduced maize yields but increased lucerne yields. None of the deep-placement treatments increased yields to a sufficient extent to be of any practical value.—R.B.

2003† Institut für Grünlandwirtschaft und Futterkonservierung der Forschungsanstalt für Landwirtschaft Braunschweig-Völkenrode. Mehrzwecklagerhaus. [**Multipurpose storage houses.**] *TätigkBer. ForschVorhaben Eschede 1954-9*, Braunschweig-Völkenrode, 1959, 55–69.

The storage of fodder-beet and hay in the same storage room as potatoes was investigated. Herbage, wilted in the field to 40% moisture content, was stored satisfactorily in the potato storage house, the loss of nutrients being as little as 10–15%. Stored fodder-beet caused a greater rise in temperature than did potatoes. To store the two crops satisfactorily more frequent ventilation was required than for potatoes alone. From April onwards (as the outside temperature increased) it was impossible to store fodder-beet in this way because of heavy losses from rotting.—D.B.

SOIL AND WATER CONSERVATION

2004† Morland, R. T. **Erosion survey of the Hume catchment area. 6. Erosion, catchment efficiency and recommendations.** *J. Soil Conserv. N.S.W.* 1960, **16,** No. 1, 5–30, bibl. 17, illus.

Parts 1–5 of the survey are summarized [see *Fld Crop Abstr.* 12: 466, 1598 and 13: 469, 958, 978] and erosion and efficiency of the catchments are described. Management practices and erosion controls are recommended for different areas of the Catchment which are classified by degree of slope and suitability for cultivation.—S.M.J.

2005† James, J. W. **Erosion survey of the Paroo-Upper Darling region. 2. Land form and soils.** *J. Soil Conserv. N.S.W.* 1960, **16,** No. 1, 41–53, bibl. 17, illus.

2006† Mazurak, A. P. and others. **Rates of water entry into a chernozem soil as affected by age of perennial grass sods.** *Agron. J.* 1960, **52,** No. 1, 35–7, bibl. 9. [Nebraska Agric. Exp. Sta., Lincoln]

The rate of water penetration into Holdrege silt loam which had been cropped with *Agropyron intermedium* or *Bromus inermis* for 2, 4, 6 or 8 years was compared with that of soil on which a 5-yr rotation of fallow/wheat/maize/maize/wheat or a grass mixture had been grown for 20 yr. The ratio between rates of water entry after 10 and after 120 min irrigation was highest for the arable rotation and decreased progressively with increasing lengths of time under grass. After 8 years under grass the ratio closely approached that for plots supporting a grass sward for 20 years. Applications of N to the crops had little effect on rates of water entry.—R.B.

AGRO-METEOROLOGY AND CLIMATOLOGY

See also Abs. 1660.

2007 Tamm, E. and others. Untersuchungen über die Ausbildung des Mikroklimas in landwirtschaftlichen Nutzpflanzenbeständen. [**The structure of microclimate in stands of agricultural food crops.**] *Z. Acker- u. PflBau* 1959, **109,** No. 4, 355–83, bibl. 4, illus., English summary. [Inst. Acker- u. PflBau, Techn. Univ., W. Berlin, Germany]

Temperature, air movements, humidity and irradiation in stands of winter rye, spring barley and potatoes were studied with the aid of electrical instruments operated by remote control. The variations in these climatic factors which take place during different stages of growth of these crops are recorded in graphs. The apparatus is described and illustrated.—D.B.

2008† Army, T. J. and Hudspeth, E. B. **Alteration of the microclimate of the seed zone.** *Agron. J.* 1960, **52,** No. 1, 17–22, bibl. 15, illus. [Western Soil and Water Mgmt Res. Br. USDA, Fort Collins, Colorado, and Crop Prod. Engng Res. Br. USDA, Bushland, Texas]

Seed of Blackwell switchgrass (*Panicum virgatum*), RS-610 sorghum and Concho wheat were sown in air-dry soil overlying damp soil at Bushland, Texas, and the soil surface was left uncovered or covered with aluminium paint, white enamel paint, roofing paper, or clear or black polyethylene sheeting. All soil coverings improved

moisture conditions in the seed zone. Normal seedling development occurred only on uncovered plots and those covered with clear polyethylene sheeting. Soil temperatures under the latter were extremely high.—R.B.

2009† Boughner, C. C. and Kendall, G. R. **Growing degree-days in Canada.** *Circ. 3203 Met. Br. Dep. Tpt Canada* 1959, pp. 22, maps 9.

Tables are given of accumulated degree-days F above 42°F for each month of the years 1957 and 1958 at 146 locations in Canada. Maps are presented showing the following isolines : average date of beginning of vegetative season ; average date of end of vegetative season ; accumulated temperatures above 42°F on an annual basis, and also for the period 1 May–30 Sept., for 1957, 1958, and for both years combined.—R.B.

2010† Wiltshire, G. R. **Rainfall intensities in N.S.W.** *J. Soil Conserv.* 1960, **16,** No. 1, 54–70, illus.

2011† Demortier, G. La pluie artificielle. [**Artificial rain.**] *Rev. Agric., Brux.* 1960, **13,** No. 3, 299–340, bibl. 238, maps. [Sta. Chimie et Phys. agric., Gembloux, Belgium]

This article examines the possibilities of artificial rain making. Information is given on meteorology, in particular the theories on the formation of atmospheric precipitations, and on methods and substances employed for producing artificial rain. Although some success has been obtained under certain conditions, it is considered improbable that cloud seeding can produce wide-scale results.—E.B.O.

2012† Tanganyika Agricultural Corporation. [**Meteorological records at Kongwa.**] *Rec. Res. Wk, Kongwa Past. Res. Sta.* 1959, 2–7.

Rainfall for the years 1947–59, water evaporation for 1954–9, humidity and minimum and maximum temperatures for 1953–9 and hours of sunshine for 1955–9 at the Pasture Research Station, Kongwa, are tabulated.—S.M.J.

2013† Elías, C. F. Cálculo de la evapotranspiración potencial mensual en " El Encín " (Agosto 1957–Diciembre 1959) por el método de Penman. [**Calculation of potential monthly evapotranspiration at El Encín (Alcalá de Henares, Spain) (Aug. 1957–Dec. 1959) by Penman's method.**] *Bol. Inst. nac. Invest. agron.* 1960, **20,** No. 42, 93–111, bibl. 12, English and French summaries.

2014† Azevedo, A. L. and Guerra, J. G. Breve nota sobre o clima de Angola e o homen. [**Short note on the climate of Angola and on man.**] *Agros, Lisboa* 1960, **43,** No. 1, 1–12, bibl. 12, English summary. [Inst. Sup. Agron., Lisboa, Portugal]

2015 Soubies, L. and others. Le climat de la région toulousaine et son influence sur les récoltes de blé et de maïs. [**The climate in the Toulouse region and its influence on the yields of wheat and maize.**] *C.R. Acad. Agric. Fr.* 1960, **46,** No. 4, 185–95, bibl. 5.

A study of climatic data and yields of wheat and maize during 1881–1945 in Haute-Garonne, France, indicated that after a period of about 30 years during which climate was relatively favourable to wheat and maize (the 2 principal crops of the region), there followed a 30-year period during which climate, mainly in terms of rainfall, was unfavourable to these crops. It has been demonstrated that these unfavourable conditions can be mitigated by using improved varieties and techniques.—E.B.O.

2016† Baudière, A. and Emberger, L. Sur la notion de climat de transition, en particulier dans la domaine du climat méditerranéen. [**On the notion of transition climate, particularly in the sphere of the Mediterranean climate.**] *Bull. Serv. Carte phytogéog.* (*B*) 1959, **4,** No. 2, 95–117, bibl. 16.

This study is concerned with the notion of transition climate from a biological point of view, and takes the Mediterranean climate as an example and rainfall as a climatic element. In France the Mediterranean climate, characterized by summer drought, changes gradually on moving inland from the Mediterranean shores. There are, therefore, regions where the climate is transitional between the Mediterranean climate and a continental or oceanic one and in different years elements of one or the other of these climates prevail.—E.B.O.

2017† Crisp, D. J. **The influence of climatic changes on animals and plants.** *Geogr. J.* 1959, **125,** No. 1, 1–19, bibl. 71, illus.

MISCELLANEOUS

2018† OEEC. Agricultural policies in Europe and North America. Further problems in agricultural policy. Vol. 1. *4th Rep. Minist. Comm. Agric. Fd* 1960, pp. 352.

2019 Der Khatchadourian, L. and Péquignot, R. 8. Évolution des grandes productions végétales au cours des dernières campagnes. [**8. Evolution of the principal crops during the**

past seasons (in France).] *C.R. Acad. Agric. Fr.* 1960, **46,** No. 6, 320–44, maps. [Chaire d'Agric., Grignon, France]

Information is given on areas, yields and regions of production of wheat, oats, barley, grain-maize, sugar-beet, potatoes and oil crops in France.—E.B.O.

2020† Kopetz, L. M. Der Einfluss pflanzenbaulicher und züchterischer Massnahmen auf die Qualität. [**The influence of cultivation and breeding on quality.**] *Bodenkultur* 1959, **10,** No. 4, 373–8. [Inst. PflBau u. PflZücht., Hochsch. f. Bodenkultur, Wien, Austria]

The cultivation aspect dealt with in this paper is manuring for quality (with special reference to protein content) as well as for yield.—D.B.

2021 Llewelyn, J. C. **Crop variety testing.** *Rep. Nottingham Univ. Sch. Agric. 1959* 1960, 57–62.

The results are given of varietal trials at Nottingham in 1959. Yields are expressed as percentages of the controls and are the means of yields obtained at 3 levels of applied N. Of 11 varieties of winter wheat, Elite Lepeuple and Professeur Marchal gave yields similar to the control, Hybrid 46, which yielded 40·7 cwt/ac. In spring-wheat trials, Probat and Koga II gave significantly higher yields (12 and 11%, respectively) than the control Atle, which yielded 37·6 cwt/ac. In spring-barley trials, Mentor gave 4% higher yields than Proctor, which yielded 35·7% cwt/ac. Of winter oats E.2295 gave 28% higher yields than S.147, the control (22·4 cwt/ac). Of spring oats tested, Condor gave 3% higher yields than Sun II, the control (29·6 cwt/ac). In a maincrop potato trial Ulster Beacon and Ulster Glen gave slightly higher total yields than Majestic (13·6 ton/ac) and yielded 66 and 27%, respectively, more tubers over 2 in. in diameter than Majestic, which yielded 6 tons/ac. In other trials Katahdin and Ontario yielded considerably more tubers over 2 in. in diameter than Majestic, which yielded 4 ton/ac. Of yellow-fleshed potatoes E.57 (Clarke) yielded 103% more tubers over 2 in. than Majestic (4·4 tons/ac). Of 5 sugar-beet varieties tested, only Polyrave yielded more sugar/ac (3% more) than did the control, Sharpe's Klein E, which yielded 2·55 tons/ac. In a silage-maize trial, Maisking 5 gave 14% higher dry-matter yields than the mean for all varieties (37·7 cwt dry matter/ac).—S.M.J.

2022 Stephens, D. **Fertilizer trials on peasant farms in Ghana.** *Emp. J. exp. Agric.* 1960, **28,** No. 109, 1–15, bibl. 7. [Dep. Agric., Ghana]

Fertilizer trials were laid out on peasant farms in Ghana in continuance of those reported in *Fld Crop Abstr.* 7 : 253 and 1013, and 8 : 239, to establish the major nutrient deficiencies of the different areas and determine the best economic use of fertilizers under present conditions. In groundnut trials in the N. savannah during 1950–6, plots received different dressings of single and triple superphosphate and gypsum placed round the plants 1–2 weeks after emergence. The 120 lb/ac rate of single superphosphate in all cases resulted in the highest yield increases (an average of 324 lb shelled nuts/ac over untreated plots). Where kraal manure had been applied, single and triple superphosphate were equally effective. The application of dung improved fertility more than did a grass fallow. In experiments in which mixed plots of millet and guinea corn received various applications of $(NH_4)_2SO_4$ and superphosphate at different stages of growth, P had a greater effect on yield than N and the optimum application was 1 cwt superphosphate/ac. Mean yields were greater where millet and guinea corn followed groundnuts. The application of $(NH_4)_2SO_4$ to rice considerably reduced yields.—S.M.J.

2023 Okuda, A. and others. **Nitrogen-fixing microorganisms in paddy soils. 4. Nitrogen fixation by photosynthetic bacteria (*Rhodopseudomonas capsulatus* species) under various conditions.** *Soil Pl. Fd* 1959, **5,** No. 2, 73–6, bibl. 7. [Kyoto Univ., Japan]

[See also *Fld Crop Abstr.* 11 : 580.]

2024 Hiraiwa, Y. K. and others. **Damages of agricultural products caused by the Norway rat in Sagi-shima, a delta of Nobeoka City, Miyazaki Prefecture. 1. Preliminary surveys and considerations on the cause of rat outbreaks. 2. Rat control with special reference to the introduction of the Korean weasel as a natural enemy against rats.** [Japanese] *Sci. Bull. Fac. Agric. Kyushu* 1959, **17,** No. 3, 321–49, bibl. 26, illus., English summaries.

In the first paper an account is given of an animal-population survey and the crop depredations caused by *Rattus norvegicus* whose main diet consists of wheat and sweet-potato. The second paper gives an account of control measures. The introduction of the Korean weasel (*Mustela sibirica coreana*) to the area resulted in a marked decrease in the rat population and improvement in crops. It was estimated that, for effective control, 20–30 weasels would be required per square kilometre. F. Eng. S.—D.B.

2025 Biologische Bundesanstalt für Land- und Forstwirtschaft, Berlin-Dahlem. **32nd German Plant Protection Conference, Hannover, 6–10 Oct. 1958.** *Mitt. biol. Bundesanst. Land- u. Forstwirtsch.* 1959, No. 97, pp. 261, bibl., illus.

Papers on weed control include weed control with a new herbicide (neburon) by R. Immel. There was a series of papers on warning services and forecasting of attacks by wheat gall-fly (*Contarinia tritici*), *Aphis fabae* on beet stands, and by nematodes. Among the papers on seed treatment were : Progress and problems of disinfection and seed treatment, by K. Böning ; The microflora of barley grain and the selective influence of disinfection, by G. Roth ; Problems in the chemical control of *Ustilago nuda* and *U. tritici*, by F. Wagner. —D.B.

2026 Fisons Pest Control. **Rogor. Technical Information.** *Publ. Fisons Pest Control* Chesterford Pk Res. Sta. 1960, unpaginated. [Received May 1960]

Recommended rates of application of rogor, active ingredient : O, O-dimethyl S- (N-methylcarbamoylmethyl) phosphorodithioate, (dimethoate), are included for wheat, oats, sorghum, rice, peas, potatoes, cotton and sugar-beet.—S.M.J.

2027† Bärner, J. [Ed.] Bibliographie der Pflanzenschutzliteratur 1953. [**Bibliography of literature on plant protection 1953.**] 1960, pp. 568, West-Berlin : Verlag Paul Parey. [Biol. Bundesanst. f. Land- u. Forstwirtschaft, Berlin-Dahlem]

Approximately 30,000 references are grouped as follows : (1) diseases (including weed infestations) and their causes ; (2) diseases and their host plants which include cereals, potatoes, beets, oil-bearing plants, fibre crops, forage legumes and grasses (tropical crop plants being grouped together) ; (3) control measures and legislation. The contents are given in German, English and French, and there is an author index. [See also *Fld Crop Abstr.* 13 : 1000.]—D.B.

REPORTS

2028† **Great Britain.** Report of the Rothamsted Experimental Station for 1959. Harpenden, 1960, pp. 288, 1 map.

See Abstracts 1586, 1764, 1765, 1770, 1778, 1791, 1891, 1903, 1905, 1906, 1960, 1973, 1979.

2029† **Great Britain.** Report of the School of Agriculture, University of Nottingham for 1959. Sutton Bonington, 1960, pp. 91.

See Abstracts 1822, 1958, 2021.

2030 **Great Britain.** Report of the Norfolk Agricultural Station for 1958–59. Norwich, 1959, pp. 23, illus.

See Abstracts 1574, 1577, 1631, 1771, 1797, 1808.

2031 **Great Britain.** Tenth Annual Report 1959, National Vegetable Research Station, Wellesbourne, Warwick. 1960, pp. viii + 63, illus., 3 maps.

See Abstracts 1758, 1969.

2032† **Germany.** Tätigkeitsbericht über das Forschungsvorhaben Eschede in den Jahren 1954–1959. [Report of work at the research farm at Eschede during the years 1954–9.] Braunschweig-Völkenrode : Forschungsanstalt für Landwirtschaft, 1959, pp. 89, illus.

See Abstract 2003.

2033† **Switzerland.** Tätigkeitsbericht der Eidgenössischen Landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon über das Jahr 1958. [**Report of activities of the Federal Agricultural Research Institute, Zürich-Oerlikon for 1958.**] *Landw. Jahrb. Schweiz* 1959, **73,** No. 7, 659–733.

See Abstracts 1621, 1818.

2034 **Nigeria.** West African Stored Products Research Unit. Department of Marketing and Exports, Nigeria. Annual report for 1958. Lagos, [n.d.], pp. 68. [Received July 1960]

See Abstract 1752.

2035† **Kenya.** Colony and Protectorate of Kenya, Department of Agriculture. Annual Report for 1958. 2. Record of Investigations. Nairobi, 1960, pp. 167. [Received May, 1960]

See Abstracts 1638, 1967.

2036 **Tanganyika.** Annual Report of the Department of Agriculture, 1958. Pt 2 (Research). Dar-es-Salaam, 1959, pp. 33.

See Abstracts 1647, 1747, 1749.

2037† **Tanganyika.** Tanganyika Agricultural Corporation. Pasture Research Station, Kongwa. Record of Research Work 1958–59. [n.d.], pp. 42. [Received May, 1960]

See Abstract 2012.

2038 **Nyasaland Protectorate.** Empire Cotton Growing Corporation. Progress Reports from Experiment Stations. Season 1958–59. London, 1960, pp. 12. [Received May, 1960]

See Abstracts 1748, 1849, 1865, 1994.

2039 **Hong Kong.** Annual Departmental Report by the Director of Agriculture, Fisheries and Forestry for the financial year 1958–9. Hong Kong, [n.d.], pp. 97, illus.

See Abstract 1716.

BOOKS

2040 Ministry of Agriculture, Fisheries and Food. **Sugar beet cultivation.** *Bull. 153 Minist. Agric. Fish. Fd* (2nd edn) 1960, pp. 114, illus., London : HMSO, 8s. 0d. [Received July 1960]

This bulletin, first published in 1953, has been completely revised and includes a discussion of the advantages of down-the-row thinning compared with cross-blocking, advice on manuring and on chemical control of weeds.—S.M.J.

2041 MacFarland, C. S. [Ed.] **American Potato Yearbook 1960.** 1960, pp. 80, bibl. 243, illus., 6 maps, 15 × 22·5 cm, Westfield, New Jersey : C. Stedman Macfarland, $2.

The contents of this publication include : a paper entitled Potato diseases and their control, by J. C. Campbell (pp. 17–23) ; a list of recent references to literature on potato culture and research published in the USA and Canada ; details of standards for ware and seed potatoes current in the USA ; and statistics of potato production in the USA and Canada.—R.B.

2042 Campbell, J. C. [Ed.] **1960 Potato Handbook.** 1959, Vol. 5, pp. 80, illus., 15 × 22·5 cm, New Brunswick, New Jersey : Potato Association of America, $2.

This issue of the Potato Handbook is primarily devoted to the industrial processing of potatoes for potato crisps, frozen potato products, dehydrated and tinned potatoes, potato flour and other purposes. Quality and variety of potatoes for each process are specified. Tables are given of the production of certified seed potatoes in the USA in 1959. Sources of certified seed are given.—R.B.

2043 Jugenheimer, R. W. **Hybrid maize breeding and seed production.** *Agric. Devel. Pap. 62 FAO* 1958, pp. xii + 369, bibl. 1518, illus., 23·5 × 16·5 cm, Rome : FAO, 22s. 6d.

2044† Moore, I. **Winter keep on the farm.** 1960, pp. viii + 86, illus., 19 × 12 cm, London : Farmer and Stockbreeder Publ. Ltd, 9s. 6d.

This book is the most recent of several which have been written by Professor Ian Moore on practical aspects of farming in Great Britain. The greater part of it is devoted to a detailed consideration of the economics, production and utilization of kale. The author attaches great importance to the value of this crop in winter-feeding programmes and draws on considerable practical experience and experimental data to support his views. Other crops for winter-feed, including cabbage, rape, swedes, turnips, mangels, fodder-beet and kohl-rabi, are also discussed, but in less detail, as are the use of cereals (including rye) and Italian ryegrass for early spring grazing. There is, however, no specific reference to the production of foggage, which is now an accepted form of winter-keep in this country. The book is easy to read and understand. It contains much useful and up-to-date information and should be of sound practical value to farmers and agricultural students.—J. E. Rudman.

2045 Pillai, M. S. **Cultural trials and practices of rice in India.** 1958, *Indian Council Agric. Res.* Monograph No. 27, pp. 172, bibl. 23, 25 × 19 cm, 12s. 6d. [Received June 1960]

This monograph, written for extension workers, is a compilation of material from published reports and unpublished records of experiment stations and from Rice in Madras, by K. Ramiah. The contents include chapters on : land preparation for dry, semi-dry and wet cultivation of rice ; sowing methods for dry and wet cultivation of rice ; transplanting ; irrigation, weeding and manuring ; harvesting and threshing ; rotation practices ; pests and diseases ; short notes for extension workers on weather and on existing rice-cultivation practices in 15 States of India. Appendices give tabulated data on sowing, transplanting, spacing, yields and water requirements, threshing costs, list of research stations and their soils in 11 States, climatic data, and a glossary of vernacular names of crops. —D.B.

2046 International Potash Institute, Berne, Switzerland. **The manuring of rice in India.** 1959, pp. 39, 21 × 14 cm, Berne : Intern. Pot. Inst.

2047 Sethi, B. L. and others. **Cotton in India. A monograph. Vol. 1.** 1960, pp. xiv + 474, bibl. at end of chaps, illus., maps, 26 × 19 cm, Bombay : Indian Central Cotton Committee, 54s, Rs. 30.

The complete work is described as a comprehensive monograph embodying the results of research in India and elsewhere. The present volume has 8 chapters entitled : history of cotton, climate and soils, taxonomy, morphology, embryology, breeding, cytology, genetics. Later volumes, said to be ready for printing, will deal with (II) physiology, agronomy, diseases and pests, seed multiplications ; (III) technology, marketing, legislation ; (IV) six regions growing various combinations of the species *arboreum*, *herbaceum* and

hirsutum. This is a wide field to cover. But India has made important contributions to cotton research and she has every right to undertake this task, whose outcome, if successful, will be most valuable. Only the first 4 chapters of Vol. 1 concern this bureau. The history of cotton in India starts at Mohen-jo-daro, five thousand years ago, with the most ancient fabrics known to the world. A lively export trade can be traced back through half this interval of time, first to Greece and Rome by the overland route, and later by sea round Africa to western Europe. Competition brought about by the industrial revolution in 18th century England was a serious setback, but India was quick to respond. Her first textile mill was erected in 1814. The main burden of this book, however, is the scientific effort of the Indian Central Cotton Committee since its establishment in 1921. This includes the surmounting of a second setback—when the separation of Pakistan in 1947 removed most of the long-staple cotton and a great deal of irrigated land. At the present time, India has the greatest area of cotton of any country in the world and the third largest crop. The climate and soils of a sub-continent can be described only briefly in the space available. The cotton crop is concentrated in the Peninsula and the Punjab (between 70° and 80°E. long.) and is not much grown in the wet areas to the east (e.g. Bengal) or the very dry area to the west (west Rajasthan). Alluvial soils predominate for the rainfed and irrigated crops in the North, and black cotton soils, usually deficient in N, P and organic matter, for the rainfed crops further south. It is a pity that the soil analysis table on pp. 56–9 contains so many gaps. The chapter on taxonomy is rightly founded on the classical work of Sir Joseph Hutchinson, who held a post at Indore in the late 1930's. The assembling of so many key tables into a compact space is a valuable service, although some could be brought up-to-date with advantage. For example, on p. 67 *Gossypium somalense* is now known to have a range which extends much further west in Africa. The interesting morphology of the cotton plant is treated in considerable detail, but, being rather technical, will only appeal to the specialist. The all-important subject of the cotton fibre deserves better illustration than it gets in Figure 12. The English composition is beyond reproach and reads easily. The type is also satisfactory and there are very few misprints. But the binding is very weak indeed and the particles of seed coat in the cloth cover, though technically interesting, are hardly a good advertisement for an important book on cotton.—J. D. Jameson.

2048 Kundu, B. C. and others. **Jute in India.** 1959, pp. 395, bibl. 430, illus., Calcutta : Indian Central Jute Committee, 27·5 × 21·5 cm, Rs. 30. [Received 1960]

Appropriately bound in jute cloth, this volume sets out to present, in the form of a monograph, comprehensive information on the botany, cultivation and technology of jute previously available only in separate papers in various scientific journals. This admirable object has been in general well achieved and the example could with advantage be followed in the case of many other tropical and sub-tropical crops. The subject is dealt with in these sections : Agriculture (184 pp.), Economic and marketing problems (150 pp.) and Science and technology (61 pp.). The first section deals with the botany of the two cultivated species, *Corchorus capsularis* and *C. olitorius*, breeding methods and the characteristics and performance of the improved strains produced, genetics and cytogenetics, anatomy and physiology of the plant and the soil and climate demanded by the crop. This is followed by an informative chapter on the sequence of cultivation operations on the commonly broadcast crop, fully described and illustrated, and the improvement in yield and reduction in labour requirement achieved by planting as a row crop and intercultivating with a hand operated wheel-hoe. Row planting has required the development of a special seed drill, which is fully described. Manuring and fertilizing the crop is dealt with in rather too general terms : while it is clear that the main requirements can best be met by judicious use of organic manures and nitrogenous fertilizers, which have been found to increase the yield by 30 – 200% " depending on the fertility of the soil and other factors ", no attempt is made to correlate the responses with these factors. The chapter describes the rotational cropping of jute with rice and sometimes a third (pulse) crop in the same year, and concludes with sections on harvesting, retting, yields and cultivation costs. Chapters on fibre quality as affected by cultivation practices, on seed production and on diseases and pests and their control bring the first section to a close. The second section deals comprehensively with the economics of the crop both on the farm and within the budget of the peasant grower, and also with larger scale aspects of transport and marketing, price fluctuations and the world market. The chapter " Problems of the jute grower " reveals the vicious circle (financial stringency — lowered cultivation standards — greater financial stringency) which so often hinders crop improvement in peasant communities. The final section deals with the physical and chemical characteristics of jute fibre and with finishing, processing, spinning and weaving. While there is some inconsistency in units employed (seers and maunds rub shoulders with pounds and acres) the book in general eschews local terminology, is presented in a very readable style, is uniformly well illustrated with clear photographs and diagrams, and has a comprehensive bibliography.—J. H. Gisborne.

2049† Harper, J. L. [Ed.] **The biology of weeds. A symposium of the British Ecological Society, Oxford 2-4 April, 1959.** 1960, pp. xv + 256, bibl. at end of papers, illus., 15 × 23 cm, Oxford : Blackwell Scientific Publications Ltd, 42s. 0d.

This symposium was convened in order to bring together research workers (concerned with the taxonomy, genetics, physiology and ecology of weeds) from the universities, research organizations and industry. The following are among the papers given : The history of weeds in Britain, by H. Godwin ; Some reflections on the ecology of weeds, by A. H. Bunting ; Patterns of change within grassland communities, by H. Lieth ; Some taxonomic problems in weed species, by E. F. Warburg ; Dormancy in weed seeds, by J. M. Thurston ; Germination of the seeds of angiospermous root parasites, by N. Sunderland ; Assessment and control of the dissemination of weeds by crop seeds, by P. S. Wellington; The control and eradication of weeds in seed crops, by S. Hitchings ; Factors controlling plant numbers, by J. L. Harper ; Studies on plant competition, by J. K. A. Bleasdale ; Studies on the mutual influences of weeds and crops, by P. Martin and B. Rademacher ; The influence exerted by species of *Camelina* on flax, by means of toxic substances, by G. Grümmer and H. Beyer ; Toxin production from *Agropyron repens*, by P. J. Welbank ; Species of *Acacia* as weeds, by G. W. Ivens ; The ecology of some New Zealand woody weeds, by E. C. S. Little; The water hyacinth and the Sudan, by P. A. Gay; *Nardus stricta*, weed of hill grazings, by M. J. Chadwick .—M.H.

2050 Williams, H. T. [Ed.] **Principles for British agricultural policy. A study sponsored by the Nuffield Foundation.** 1960, pp. xiv + 317, 22 × 15 cm, London, New York, Toronto : Oxford Univ. Press, 18s.

2051† Cooke, G. W. **Fertilizers and profitable farming.** 1960, pp. xviii + 122, 22 × 14·5 cm, London : Crosby Lockwood and Son Ltd, 15s.

The productivity of British agriculture has greatly increased in the last 20 years. During the same time there has been a marked increase in the use of fertilizers, for which the annual bill is now 90 million pounds. How to get the best return from this outlay is the purpose of this book. Addressed primarily to farmers, its basic aim is to show how fertilizers can be used profitably. Backed by many years of lecturing to farmers, Dr. Cooke's examination of the results of many trials designed to test different quantities of plant foods and to measure the extra yields obtained has enabled him to make detailed recommendations for optimum fertilizer use on grassland and on the more important arable crops. As every farmer knows, recommendations for fertilizer applications are no more than a sound guide. Adjustments must be made to allow for the effects of climate, season, type of soil and level of fertility, previous cropping and manuring, price changes and other related factors. Local knowledge counts for a great deal. These factors are given full weight by Dr. Cooke. Indeed one of the great merits of this outstanding contribution to the farmer's library is that it illustrates how work in the academic field fits neatly into the context of everyday practice. No farmer can go very far wrong by following the recommendations given in this book. Very many will find the way to larger profits — if, in the case of those specialising in intensive grass production, they can find the extra capital for grass utilization. A few will be surprised to learn that perhaps they are being over-generous with fertilizers, particularly potash.—A. K. Smith.

2052 Gericke, S. and Jürgens-Gschwind, S. Düngung im Getreidebau. [**Manuring for cereal cultivation.**] 1959, pp. 63, bibl. 69, illus., 21 × 14 cm, Essen : Tellus Verlag. [Landw. Versuchsanst., Thomasphosphat-Erzeuger, Essen-Bredeney, W. Germany]

2053† Whyte, R. O. **Crop production and environment.** 2nd edn, 1960, pp. 392, bibl. 622, illus., 22 × 14·5 cm, London : Faber and Faber, 63s.

A noteworthy development in plant biology during the past decade has been the great awakening of interest in the plant as an organism. Concurrently with the continued exploration of the physiology of processes in cells and tissues, many workers are now attempting to evaluate the relative significance of the different physiological processes during growth, to examine the quantitative aspects of the growth of whole plants and of organs, and to investigate the environment and its interactions with plants growing therein. The whole of this field is beyond the scope of a single treatise and Dr. Whyte, although he touches on many more aspects in this completely rewritten edition than in the first edition [*Herb. Abstr.* 17 : 871], has selected from it those aspects concerned primarily with the change from the vegetative to the flowering state. Within this context, the volume is a valuable guide to the published work on the physiological mechanisms involved and the differing responses of a wide range of crops, but, because of it, a very narrow viewpoint of the problems of crop production in relation to the environment is presented. Dr. Whyte is well aware of this and has appended in the text guides to the wider quantitative issues. The reader can therefore find his way quickly to recent contributions on subjects such as the leaf-area index (but not net assimilation rates), tillering

in grasses, competition for light (but not nutrients), tuberization in the potato, and equipment for growing plants in controlled environments. For a book with this title, the discussion of the natural environment is disappointing. This is confined to the reproduction, without textual comment, of isopleths of incoming radiation in January and July, two uncited references to temperatures within a crop, two references to climatological approaches without discussion or warranted criticism, and a graph of the variation in daylength with season for latitudes 42°–62°N. The book is primarily directed to the agricultural botanist in the widest sense. In the author's words, it " represents a report of a shadow conference at which the sayings and writings of specialists in this subject from different countries are presented, as nearly as possible in their own words. The result is a picture . . . unavoidably still somewhat shapeless and untidy ". This approach to the subject is extremely fair to the authorities cited although it leads to many unresolved conflicts of opinions. Consequently, the novice may be somewhat bewildered by the form, composition and texture of the picture but the connoisseur will find much of interest which will exercise his talents of judgement, taste and discrimination.—F. L. Milthorpe.

2054† Clapham, A. R. and others. **Flora of the British Isles. Illustrations Part 2, Rosaceae - Polemoniaceae.** Drawings by Sybil J. Roles. 1960, pp. v + 119, 29 × 21·5 cm, Cambridge Univ. Press, 25s.

[See also *Fld Crop Abstr.* 12 : 1052.] This second part of the Illustrations follows the same general pattern as the first.—M.H.

2055† Louis-Marie, P. Flore-manuel de la Province de Québec, Canada. [**Handbook of the flora of the Province of Quebec.**] 3rd edn, [n.d.], pp. 322, illus., 16 × 24 cm, Montreal : Centre de Psychologie et Pédagogie, $3·50.

This book differs from the usual type of flora in that it contains chapters on : general botany, principles of classification, non-vascular cryptogams, ecological factors, phytosociology and life form, and plant distribution. A key is provided for the identification of the principal vascular plants of Quebec, most of which are illustrated in colour. The classification used is based on that of Engler and Prantl. One of the most useful features of the book is that, in addition to scientific names, both the English and French common names of plants are given, a great assistance to the better understanding of some of the Canadian literature, notably that on weed control. There is an index of species, an appendix on medicinal plants, and a detailed glossary.—R.B.

2056† Feijão, R. O. Elucidário fitológico. Plantas vulgares de Portugal continental, insular e ultramarino. (Classificação, nomes vernáculos e aplicações). Volume 1. A-H. [**Phytological commentary. Common plants of Portugal (continent, islands and overseas). (Classification, popular names and uses). Vol. 1. A-H.**] 1960, pp. 472, 23 × 16 cm, Lisboa : Inst. Bot.

The plants are classified by their popular names. Scientific names and brief descriptions of the plants are also given.—E.B.O.

2057 Commonwealth Scientific and Industrial Research Organization. **The Australian environment.** 3rd edn, 1960, pp. 151, illus., 25 × 18 cm, London and New York : Cambridge Univ. Press, 30s.

This 3rd edition, which has been completely revised by the original authors, has been prepared to meet a continuing demand for the book. It follows the earlier editions in arrangement and includes chapters on: physical geography, climates, soils, development of agriculture, water and irrigation, vegetation, pastures, field crops and sheep, cattle, and pigs.

The book was originally prepared for delegates to the Specialist Agricultural Conference on Plant and Animal Nutrition in Relation to Soil and Climatic Factors, held in Australia in August 1949 as one of a series of British Commonwealth Official Scientific Specialist Conferences. It aimed at providing delegates with some understanding of the history and present stage of development of the plant and animal industries of Australia against the background of their environment. It was felt that the purpose of the book would be achieved if it led visitors to want to know more of the country with which it deals, a continent old in geological time but very young in terms of land settlement which offers to the scientific worker a variety of complex and fascinating problems.

There are four coloured maps, one black-and-white map, 32 text figures, and 32 photographs.

2058 Foster, J. F. [Ed.] **Commonwealth Universities Yearbook 1960.** 1960, pp. xxxi + 1509, bibl., 24·5 × 17 cm, London : The Assoc. of Universities of the British Commonwealth, 87s. or $13.00.

The Yearbook is produced by the Association of Universities of the British Commonwealth as a directory to university institutions of good standing in all the countries of the Commonwealth. A new and revised volume is produced each year, and, in the 1960 edition, 5 new universities are listed : Monash University in Australia, and Gorakhpur, Jabalpur, Marathwada and Vikram Universities in India.

Information on each University is provided under the following headings : (1) principal officers, (2) teaching staff, (3) administrative and other staff, (4) constituent or associated institutions, (5) general information, (6) ' the year 1958'.

Among the 7 appendices is one dealing with the 7000 full-time students from Commonwealth countries who were enrolled at UK universities in the last academic year and there is also a special appendix devoted to the Commonwealth Scholarship and Fellowship Plan to which effect is now being given by the various governments.—C.L.S.

2059† Boalch, D. H. **World directory of agricultural libraries and documentation centres.** 1960, pp. 280, Harpenden, Herts : Internat. Assoc. Agric. Librarians and Documentalists.

2060† Steward, F. C. **Plant physiology. A treatise. Vol. 1 A. Cellular organization and respiration.** 1960, pp. xxvii + 331, bibl. 178, illus., 23 × 16 cm, London and New York: Academic Press, 93s.

This work is in 3 chapters and is concerned with (1) the plant cell and its inclusions; (2) proteins, enzymes and the mechanism of enzyme action; and (3) cellular respiration.—M.H.

NEWS AND NOTES

France

2061† African Legumes. H. Rabechault intends to publish the drawings of 55 African legumes in issues of *Riz et Riziculture*. The plates will eventually be collected in a separate publication. *Arachis hypogaea, Cicer arietinum, Glycine max, Sphenostylis stenocarpa, Trigonella foenum-graecum* and *Voandzeia subterranea* are illustrated in *Riz et Rizicult.* 1960, **6**, No. 1, with notes on popular names and botanical characteristics.—E.B.O.

2062 Oil Crops. *Oléagineux* 1960, **15**, No. 5 is a special number devoted to oil crops in the French community and is concerned with problems of agricultural production.—E.B.O.

Romania

2063 Department of the Food Industry. The following papers [in Romanian, with Russian and French summaries] have been published in the Lucrările Institutului de Cercetări Alimentare, Vol. 3, 1959 : The production of carotene from lucerne and the possibilities of using it in the food industry, by I. Marinescu and M. Cotutin ; Boron as a micro-element used in sugar-beet production, by G. Olteanu ; and New research on gummosis in sugar-beet, by A. Racoviță. [See Abs. 1783.]—M.H.

Yugoslavia

2064 Wheat Production. In 1959, Yugoslavia was for the first time self-supporting in wheat, having filled the annual deficit of 10 million cwt. This result was achieved by the introduction of high yielding Italian varieties, improved agricultural practices and the use of fertilizers. The project was started in 1957 with the help of the Italian " Ente Nazionale Sementi Elette ", but was taken over by FAO in the following year. Climatic conditions are generally favourable for wheat in the plains of Vojvodina, Serbia, Croatia and Slovenia, which have a well distributed rainfall. In Vojvodina the Italian wheats were grown on 124,500 ha and yielded an average of 44·2 cwt/ha. The variety San Pastore comprised 60% of the total area sown with Italian wheat and gave the highest average yield. *Features Sect. FR-53 FAO* 1960.—E.B.O

Austria

2065 Landwirtschaftlich-Chemische Bundesversuchsanstalt, Linz. A special publication was produced in Oct. 1959 to mark the 60th anniversary of the above Institute and includes the following papers : Grain moisture in relation to environment, by M. Schachl; Trials with two beet-thinning implements, by G. Frimmel and K. Kaineder ; Potato multiplication areas in Mühlviertel and Sauwald, by J. Gusenleitner and E. Maierhofer ; The effect of microflora on the viability of cereal seed, by E. Lengauer ; Results of trials on nitrogen manuring of sugar-beet and on density of stand, by J. Gusenleitner ; Wheat quality in relation to genetical constitution, manuring and storage, by G. Frimmel and N. Eder ; Experiment and research programme of the Institute on the basis of the ecological conditions of the country, by E. Burggasser.—D.B.

Kenya

2066† A Herbicide Conference was held at Muguga on 15 March 1960 to consider different aspects of the control of couch [*Agropyron repens*] and other grasses particularly by the use of dalapon. The summing up by Dr. E. W. Russell, Director of the East African Agriculture and Forestry Research Organisation, of papers presented at the conference is given in *Kenya Fmr* No. 45.—S.M.J.

Congo

2067 A Special Number of *Bulletin Agricole du Congo Belge et du Ruanda-Urundi* has been published to commemorate the jubilee of the journal, 1910–60. It reviews the history of the development of agriculture in the Congo during that period from all aspects, including research, agronomy, animal husbandry and colonization. The issue consists of 226 pages and is well illustrated, partly in colour.—E.B.O.

West Indies

2068 Imperial College of Tropical Agriculture, Trinidad. As from 31 July 1960 this College was merged with the University College of the West Indies and thereafter will be known as : University College of the West

Indies, Faculty of Agriculture, (Imperial College of Tropical Agriculture), Trinidad, West Indies.—A.G.G.H.

South America

2069 Amazon Valley. "With the use of fertilizers and proper soil management, a large part of the 5 million km^2 which comprise the Amazon Valley and its tributaries could become a very productive agricultural country" according to T. H. Day of FAO. Rainfall and temperature are highly favourable for plant growth and, except for low fertility, the soils are also generally suitable. Maize, upland rice and cassava are grown successfully on high lands, and jute and swamp rice on low lands, where annual floods deposit a new layer of soil each year and the main problem is one of drainage rather than fertility. *Features Sect. FR-50 FAO* 1960.—E.B.O.

Australia

2070 Nitrogen in Tropical Agriculture. A symposium on this subject was held in Brisbane during 23–24 Feb., 1960. It was organized by the CSIRO at the Cunningham Laboratory, the headquarters of the Division of Tropical Pastures. The symposium brought together under ready reference a number of reviews on topics of importance to the future development of tropical agriculture ; the discussions demonstrated many serious gaps in information on the role of nitrogen in the tropics and showed where further research is required. *Nature, Lond.* 18 June 1960.—M.H.

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Title	Abbreviation used
AFRICA	
INTERNATIONAL	
Monthly Analytical Bulletin of the Inter-African Bureau for Soils and Rural Economy	*Mon. analyt. Bull. B.I.S.*
Science-Afrique. CCTA/CSA	*Science-Afrique*
Sols Africains (8)	*Sols afr.*
ALGERIA	
Annales de l'École Nationale d'Agriculture d'Alger	*Ann. Éc. Agric. Alger*
Rapport du Conseil de l'Expérimentation et des Recherches Agronomiques. Algérie	*Rapp. Cons. Exp. Rech. agron., Algér.*
Revue Agricole de l'Afrique du Nord (7)	*Rev. agric. Afr. N.*
ANGOLA	
Agronomia Angolana	*Agron. angol.*
BELGIAN CONGO	
Bulletin Agricole du Congo Belge	*Bull. agric. Congo belge*
Bulletin d'Information de l'Institut National pour l'Étude Agronomique du Congo Belge	*Bull. Inform. I.N.É.A.C.*
Folia Scientifica Africae Centralis	*Folia sci. Afr. cent.*
Rapport de l'Institut National pour l'Étude Agronomique du Congo Belge	*Rapp. I.N.É.A.C.*
Rapport de l'Institut de la Recherche Scientifique de l'Afrique Centrale	*Rapp. I.R.S.A.C.*
BRITISH CAMEROONS	
Report of the Cameroons Development Corporation	*Rep. Cameroons Devel. Corp.*
EAST AFRICA HIGH COMMISSION	
East African Agricultural Journal	*E. Afr. agric. J.*
Report of the East African Agriculture and Forestry Research Organization	*Rep. E. Afr. agric., for. Res. Org.*
Report of the East African Veterinary Research Organization	*Rep. E. Afr. vet. Res. Org.*
FRENCH EQUATORIAL AFRICA	
Bulletin de l'Institut d'Études Centrafricaines	*Bull. Inst. centrafr.*
GHANA	
Ghana Farmer	*Ghana Fmr*
Journal of the West African Science Association	*J. W. Afr. Sci. Ass.*
Report of the Department of Agriculture. Ghana	*Rep. Dep. Agric. Ghana*
KENYA	
East African Farmer and Planter	*E. Afr. Fmr and Planter*
Kenya Farmer	*Kenya Fmr*

*The term periodicals as used here includes : journals, proceedings, transactions and yearbooks. Occasional bulletins and circulars are not included in the list. For key to numbers in brackets, see page xxvii.

Title	Abbreviation used
AFRICA—(*Continued*)	
KENYA—(*Continued*)	
Kenya Information Office Fortnightly	*K.I.O. Fortnightly*
Report of African Land Development in Kenya	*Rep. Afr. Ld Devel. Kenya*
Report of the Department of Agriculture. Kenya	*Rep. Dep. Agric. Kenya*
Report of the Department of Veterinary Services. Kenya	*Rep. Dep. vet. Servs Kenya*
Report of the Forest Department. Kenya	*Rep. For. Dep. Kenya*
Report of the Grassland Research Station. Kitale	*Rep. Grassl. Res. Sta., Kitale*
MOROCCO	
Terre Marocaine (2)	*Terre maroc.*
NIGERIA, FEDERATION OF	
Report of the Department of Agricultural Research. Nigeria	*Rep. Dep. agric. Res. Nigeria*
Report of the Department of Agriculture. Western Region of Nigeria	*Rep. Dep. Agric. W. Nigeria*
Report of the Produce Inspection Service of the Western Region of Nigeria	*Rep. Prod. Inspect. Serv. W. Nigeria*
Report of the West African Maize Research Unit	*Rep. W. Afr. Maize Res. Unit*
Report of the Western Region Marketing Board. Nigeria	*Rep. W. Region Mktg Bd Nigeria*
PORTUGUESE GUINEA	
Boletim Cultural da Guiné Portuguesa	*Bol. cult. Guiné portug.*
RHODESIA AND NYASALAND, FEDERATION OF	
Proceedings and Transactions of the Rhodesia Scientific Association	*Proc. Rhod. sci. Ass.*
Report of the Agricultural Experiment Station. Salisbury (Cont. in *Rhod. agric. J.*)	*Rep. agric. Exp. Sta., Salisbury*
Report of the Grasslands Agricultural Research Station. Marandellas	*Rep. Grassls agric. Res. Sta., Marandellas*
Report of the Henderson Research Station (8)	*Rep. Henderson Res. Sta.*
Report of the Secretary to the Federal Ministry of Agriculture. Rhodesia and Nyasaland	*Rep. Sec. Fed. Minist. Agric. Rhod. and Nyasald*
Rhodesia Agricultural Journal	*Rhod. agric. J.*
Rhodesian Tobacco (2)	*Rhod. Tob.*
NORTHERN RHODESIA	
Report of the Department of Agriculture. Northern Rhodesia	*Rep. Dep. Agric. N. Rhod.*
NYASALAND	
Nyasaland Farmer and Forester	*Nyasaland Fmr Forstr*
Report of the Department of Agriculture. Nyasaland	*Rep. Dep. Agric. Nyasald*
Report of the Department of Veterinary Services and Animal Industry. Nyasaland	*Rep. Dep. vet Servs, anim. Industr. Nyasald*
SIERRA LEONE	
Report of the Department of Agriculture. Sierra Leone	*Rep. Dep. Agric. Sierra Leone*
Report of the Veterinary Department. Sierra Leone	*Rep. vet. Dep. Sierra Leone*
Report of the West African Rice Research Station. Rokupr	*Rep. W. Afr. Rice. Res. Sta., Rokupr*
SOMALILAND	
Report of the Department of Agricultural and Veterinary Services. Somaliland	*Rep. Dep. agric. vet. Servs Somalild*
SOUTH AFRICA, HIGH COMMISSION TERRITORIES	
BECHUANALAND	
Report of the Department of Agriculture. Bechuanaland	*Rep. Dep. Agric. Bechuanald*
Report of the Department of Veterinary Services. Bechuanaland	*Rep. Dep. vet. Servs Bechuanald*
BASUTOLAND	
Report of the Department of Agriculture. Basutoland	*Rep. Dep. Agric. Basutold*

Title	Abbreviation used
AFRICA—(*Continued*)	
SWAZILAND	
Report of the Department of Land Utilization. Swaziland	*Rep. Dep. Ld Util. Swazild*
SOUTH AFRICA, UNION OF	
C.S.I.R. Research Review	*C.S.I.R. Res. Rev.*
Farming in South Africa	*Fmg in S. Afr.*
Journal of the Botanical Society of South Africa	*J. bot. Soc. S. Afr.*
Journal of South African Botany	*J.S. Afr. Bot.*
Onderstepoort Journal of Veterinary Research	*Onderstepoort J. vet. Res.*
Report of the National Botanic Gardens, Kirstenbosch	*Rep. bot. Gdns Kirstenbosch*
Report of the South African Council for Scientific and Industrial Research	*Rep. C.S.I.R.*
Report of the Department of Agriculture. South Africa [Cont. in *Fmg in S. Afr.*]	*Rep. Dep. Agric. S. Afr.*
Report of the Department of Commerce and Industry. Division of Fisheries. South Africa	*Rep. Dep. Commerce Industr., Div. Fish., S. Afr.*
Report of the South African Sugar Association Experiment Station	*Rep. S. Afr. Sugar Ass. Exp. Sta.*
South African Journal of Agricultural Science	*S. Afr. J. agric. Sci.*
South African Journal of Science	*S. Afr. J. Sci.*
Meat Industry	*Meat Indust.*
TANGANYIKA	
Report of the Department of Agriculture. Tanganyika	*Rep. Dep. Agric. Tanganyika*
Report of the Grain Storage Department. Tanganyika	*Rep. Grain Storage Dep. Tanganyika*
Report and Accounts. Tanganyika Agricultural Corporation	*Rep. Tanganyika agric. Corp.*
Report of the Tanganyika Sisal Growers' Association	*Rep. Tanganyika Sisal Gr. Ass.*
Report of the Tsetse Survey and Reclamation Department. Tanganyika	*Rep. Tsetse Surv. Reclam. Dep. Tanganyika*
Report of the Veterinary Department. Tanganyika	*Rep. vet. Dep. Tanganyika*
Tanganyika Notes and Records	*Tanganyika Notes*
UGANDA	
Record of Investigations. Department of Agriculture, Uganda	*Rec. Invest. Dep. Agric. Uganda*
Report of the Department of Agriculture. Uganda	*Rep. Dep. Agric. Uganda*
Report of the Department of Veterinary Services and Animal Industry. Uganda	*Rep. Dep. vet. Servs, anim. Industr. Uganda*
UNITED ARAB REPUBLIC	
EGYPT	
Annals of Agricultural Science. Faculty of Agriculture, Ain Shams University. Cairo (2)	*Ann. agric. Sci., Fac. Agric., Ain Shams Univ., Cairo*
ZANZIBAR	
Bulletin of the Department of Agriculture. Zanzibar	*Bull. Dep. Agric. Zanzibar*
Report of the Department of Agriculture. Zanzibar	*Rep. Dep. Agric. Zanzibar*
AUSTRALIA	
Agricultural Gazette of New South Wales	*Agric. Gaz. N.S.W.*
Australasian Irrigator and Pasture Improver	*Australas. Irrig. and Past. Imp.*
Australian Agricultural Newsletter	*Aust. agric. Newslett.*
Australian Journal of Agricultural Research	*Aust. J. agric. Res.*
Australian Journal of Biological Sciences	*Aust. J. biol. Sci.*
Australian Journal of Botany	*Aust. J. Bot.*
Australian Journal of Chemistry (8)	*Aust. J. Chem.*
Australian Journal of Science	*Aust. J. Sci.*
Australian Journal of Zoology	*Aust. J. Zool.*
Australian Meteorological Magazine	*Aust. met. Mag.*
Australian Science Index (C.S.I.R.O.)	*Aust. Sci. Index*
Australian Veterinary Journal	*Aust. vet. J.*

Title	Abbreviation used
AUSTRALIA—(*Continued*)	
'Commonwealth' Agriculturist	*Commonw. Agriculturist*
Contributions from the New South Wales National Herbarium	*Contr. N.S.W. Herbarium*
C.S.I.R.O. Abstracts	*C.S.I.R.O. Abstr.*
C.S.I.R.O. Wildlife Research	*C.S.I.R.O. Wildl. Res.*
Journal of the Australian Institute of Agricultural Science	*J. Aust. Inst. agric. Sci.*
Journal of the Department of Agriculture of South Australia	*J. Dep. Agric. S. Aust.*
Journal of the Department of Agriculture of Victoria	*J. Dep. Agric. Vict.*
Journal of the Department of Agriculture of Western Australia	*J. Dep. Agric. W. Aust.*
Journal and Proceedings of the Royal Society of New South Wales	*J. roy. Soc. N.S.W.*
Journal of the Soil Conservation Service of New South Wales	*J. Soil Conserv. N.S.W.*
Papers of the Queensland University Department of Botany	*Pap. Qd Univ. Dep. Bot.*
Papers of the Queensland University Faculty of Agriculture	*Pap. Qd Univ. Fac. Agric.*
Pastoral Review and Grazier's Record	*Pastoral Rev.*
Proceedings of the Australian Society of Animal Production	*Proc. Aust. Soc. Anim. Prod.*
Proceedings of the Linnean Society of New South Wales (7)	*Proc. Linn. Soc. N.S.W.*
Proceedings of the Royal Society of Queensland	*Proc. roy. Soc. Qd*
Quarterly Review of Agricultural Economics	*Quart. Rev. agric. Econ.*
Queensland Agricultural Journal	*Qd agric. J.*
Queensland Journal of Agricultural Science	*Qd J. agric. Sci.*
Report of the Australian and New Zealand Association for the Advancement of Science [Cont. in *Aust. J. Sci.*]	*Rep. Aust. Ass. Adv. Sci.*
Report of the Bureau of Investigation. Queensland	*Rep. Bur. Invest. Qd*
Report of the Commonwealth Scientific and Industrial Research Organization	*Rep. C.S.I.R.O.*
Report of the Department of Agriculture. New South Wales	*Rep. Dep. Agric. N.S.W.*
Report of the Department of Agriculture and Stock. Queensland	*Rep. Dep. Agric. Stock Qd*
Report of the Department of Agriculture. Tasmania	*Rep. Dep. Agric. Tasm.*
Report of the Department of Agriculture. Western Australia	*Rep. Dep. Agric. W. Aust.*
Report of the Division of Plant Industry, Commonwealth Scientific and Industrial Research Organization	*Rep. Div. Pl. Industr., C.S.I.R.O.*
Report of the Minister of Agriculture for South Australia	*Rep. Minist. Agric. S. Aust.*
Report of the Soil Conservation Authority. Victoria	*Rep. Soil Conserv. Auth., Vict.*
Report of the University of Sydney School of Agriculture	*Rep. Sydney Univ. Sch. Agric.*
Report of the Waite Agricultural Research Institute. Glen Osmond	*Rep. Waite Agric. Res. Inst.*
Rural Research in the Commonwealth Scientific and Industrial Research Organization	*Rur. Res. C.S.I.R.O.*
Tasmanian Journal of Agriculture	*Tasm. J. Agric.*
Transactions of the Royal Society of South Australia (7)	*Trans. roy. Soc. S. Aust.*
AUSTRIA	
Bericht über die Arbeitstagung der Arbeitsgemeinschaft der Saatzuchtleiter. Gumpenstein	*Ber. ArbsTag. ArbsGemeinsch. Saatzuchtleiter, Gumpenstein*
Bodenkultur	*Bodenkultur*
Pflanzenschutzberichte (3)	*PflSchBer.*
Versuchsergebnisse der Bundesversuchsanstalt für Alpenländische Landwirtschaft. Gumpenstein	*VersErgebn. BundesversAnst. alpl. Landw., Gumpenstein*
AZORES	
Boletim Comissão Reguladora dos Cereais do Arquipélago dos Açores (8)	*Bol. Com. reg. Cer. Açores*
BELGIUM	
Agricultura. Louvain (7)	*Agricultura, Louvain*
Annales de Gembloux	*Ann. Gembl.*
Annales de Physiologie Végétale de l'Université de Bruxelles	*Ann. Physiol. vég., Univ. Brux.*
Beknopt Verslag over Onderzoekingen (IWONL)	*Beknopt Versl. Onderz. (IWONL)*
Bulletin de l'Institut Agronomique et des Stations de Recherches de Gembloux	*Bull. Inst. agron., Gembl.*

Title	Abbreviation used
BELGIUM—(*Continued*)	
Bulletin du Jardin Botanique de l'État à Bruxelles	*Bull. Jard. bot. Brux.*
Bulletin de la Société Royale de Botanique de Belgique (10)	*Bull. Soc. Bot. Belg.*
Mededelingen van de Landbouwhogeschool en de Opzoekingsstations van de Staat te Gent	*Meded. LandbHogesch., Gent*
Publications Techniques de l'Institut Belge pour l'Amélioration de la Betterave	*Publ. tech. Inst. belge Amélior. Better.*
Publications de Vulgarisation de l'Institut Belge pour l'Amélioration de la Betterave	*Publ. Vulg. Inst. belge Amélior. Better.*
Revue de l'Agriculture. Bruxelles	*Rev. Agric., Brux.*
Sucrerie Belge (7)	*Sucr. belge*
BERMUDA	
Report of the Director of Agriculture. Bermuda	*Rep. Dir. Agric. Bermuda*
BURMA	
Report on the Land Records Administration. Burma	*Rep. Ld Rec. Administ. Burma*
CANADA	
Agricultural Institute Review	*Agric. Inst. Rev.*
Agriculture, Montréal	*Agriculture, Montréal*
Canada Handbook	*Can. Handb.*
Canadian Journal of Animal Science (8)	*Canad. J. Anim. Sci.*
Canadian Journal of Botany	*Canad. J. Bot.*
Canadian Journal of Plant Science	*Canad. J. Pl. Sci.*
Canadian Journal of Soil Science (8)	*Canad. J. Soil Sci.*
Contributions de l'Institut Botanique de l'Université de Montréal	*Contr. Inst. bot. Univ. Montréal*
Forage Notes. Ottawa	*Forage Notes*
National Research Council Review	*Nat. Res. Coun. Rev.*
Proceedings of the Annual Conference of Manitoba Agronomists	*Proc. annu. Conf. Manitoba Agronomists*
Proceedings of the Canadian Society of Agronomy	*Proc. Canad. Soc. Agron.*
Proceedings of the Eastern Section, National Weed Committee	*Proc. E. Sect. Nat. Weed Cttee* [*Canada*]
Proceedings of the Western Canadian Weed Control Conference	*Proc. W. Canad. Weed Contr. Conf.*
Proceedings of the Western Section, National Weed Committee	*Proc. W. Sect. Nat. Weed Cttee* [*Canada*]
Progress Report of the Animal Husbandry Division. Canada Department of Agriculture. Experimental Farms Service	*Progr. Rep. Anim. Husb. Div., Can. Dep. Agric., exp. Fms Serv.*
Progress Report of the Dominion Experimental Farm. Agassiz, British Columbia	*Progr. Rep. Dom. exp. Fm, B.C.*
Progress Report of the Experimental Farm. Kentville, Nova Scotia (8)	*Progr. Rep. exp. Fm, Nova Scotia*
Progress Report of Pasture Research. Canada Department of Agriculture. Experimental Farms Service	*Progr. Rep. Past. Res., Can. Dep. Agric., exp. Fms Serv.*
Report of the Commonwealth Institute of Biological Control	*Rep. Commonw. Inst. Biol. Contr.*
Report of the Department of Agriculture. Alberta	*Rep. Dep. Agric. Alberta*
Report of the Department of Agriculture. British Columbia	*Rep. Dep. Agric. B.C.*
Report of the Department of Agriculture. New Brunswick	*Rep. Dep. Agric. N. Brunswick*
Report of the Department of Agriculture. Ontario	*Rep. Dep. Agric. Ont.*
Report of the Department of Agriculture and Marketing. Nova Scotia	*Rep. Dep. Agric. Marktg Nova Scotia*
Report of the Grain Research Laboratory	*Rep. Grain Res. Lab.*
Report of the Minister of Agriculture for Canada	*Rep. Minist. Agric. Can.*
Report of the National Research Council. Ottawa	*Rep. nat. Res. Coun. Ottawa*
Report of the Ontario Soil and Crop Improvement Association	*Rep. Ont. Soil and Crop Improve. Ass.*
Report of the Quebec Society for the Protection of Plants	*Rep. Quebec Soc. Protect. Pl.*
Report on Prairie Farm Rehabilitation and Related Activities. Canada Department of Agriculture	*Rep. Prairie Fm Rehabil. Can. Dep. Agric.*
Research Report Eastern Section, National Weed Committee	*Res. Rep. E. Sect. Nat. Weed Cttee* [*Canada*]
Research Report Western Section, National Weed Committee	*Res. Rep. W. Sect. Nat. Weed Cttee* [*Canada*]
Revue d'Oka	*Rev. Oka*
Transactions of the Royal Society of Canada. Section 5	*Trans. roy. Soc. Can.* (*5*)

Title	Abbreviation used
CEYLON	
Ceylon Journal of Science. Section A. Botany (7)	*Ceylon J. Sci. (A)*
Tropical Agriculturist	*Trop. Agriculturist*
CHINA	
Acta Agriculturae Sinica (3)	*Acta Agric. sinica*
Acta Biologiae experimentalis Sinica (3)	*Acta Biol. exp. sinica*
Acta Botanica Sinica (3)	*Acta bot. sinica*
Acta Phytopathologica Sinica (10)	*Acta phytopath. sinica*
Science Record	*Sci. Rec.*
Scientia Sinica (3)	*Scientia sinica*
CYPRUS	
Countryman. Nicosia	*Countryman, Nicosia*
Report of the Department of Agriculture. Cyprus	*Rep. Dep. Agric. Cyprus*
CZECHOSLOVAKIA	
Annals of the Czechoslovak Academy of Agricultural Sciences	*Ann. čsl. Acad. agric. Sci.*
Agricultural Economics Series	*Agric. Econ. Ser.*
Mechanization and Electrification Series	*Mech. Elect.*
Plant Production Series	*Pl. Prod. Ser.*
Sborník Vysoké Školy Zemědělské a Lesnické v Brno (Acta Univ. Agric. Silv., Brno)	*Sborn. Vysoké Skoly Zeměd. Brno*
Sborník Vysoké Školy Zemédelské v Praze (Acta Univ. Agric., Praha)	*Sborn. Vysoké Skoly Zeměd. Praze*
Vědecké Práce	*Vědecké Práce*
DENMARK	
Årsskrift den Kongelige Veterinær- og Landbohøjskole	*Årsskr. K. vet. Landbohøjsk.*
Beretning fra Forsøgslaboratoriet, København	*Beret. Forsøgslab., Kbh.*
Botanisk Tidsskrift (7)	*Bot. Tidsskr.*
Dansk botanisk Arkiv (7)	*Dansk bot. Ark.*
Dansk Frøavl	*Dansk Frøavl*
Dansk Landbrug	*Dansk Landbr.*
Nordisk Jordbrugsforskning	*Nord. JordbrForskn.*
Oikos	*Oikos*
Physiologia Plantarum (8)	*Physiol. Plant.*
Tidsskrift for Planteavl	*Tidsskr. Planteavl*
Tolvmandsbladet	*Tolvmandsbladet*
Ugeskrift for Landmænd	*Ugeskr. Landm.*
FALKLAND ISLANDS	
Report of the Department of Agriculture. Falkland Islands	*Rep. Dep. Agric. Falkland Is*
FIJI	
Agricultural Journal of Fiji	*Agric. J. Fiji*
Report of the Department of Agriculture. Fiji	*Rep. Dep. Agric. Fiji*
FINLAND	
Annales Botanici Societatis Zoologicae-Botanicae Fennicae. Vanamo	*Ann. bot. Soc. zool.-bot. fenn., Vanamo*
Maatalous ja Koetoiminta	*Maatal. ja Koetoim.*
Maataloustieteelinen Aikakauskirja	*Maataloust. Aikakausk.*
Suomen Maataloustieteellisen Seuran Julkaisuja	*Suom. Maataloust. Seur. Julk.*
Tidskrift för Lantmän	*Tidskr. Lantm.*
Valtion Maatalouskoetoiminnan Julkaisuja	*Valt. Maatalousk. Julk.*
Valtion Maatalouskoetoiminnan Tiedonantoja	*Valt. Maatalousk. Tiedon.*

Title	Abbreviation used
FORMOSA (TAIWAN)	
Journal of the Agricultural Asssociation of China	*J. agric. Assoc., China*
Memoirs of the College of Agriculture, National Taiwan University	*Mem. Coll. Agric. Nat. Taiwan Univ.*
Soils and Fertilizers in Taiwan	*Soils and Ferts, Taiwan*
FRANCE	
Agronomie Tropicale. Paris	*Agron. trop., Paris*
Annales Agronomiques	*Ann. agron., Paris*
Annales de Géographie. Paris	*Ann. Géogr.*
Annales de l'Amélioration des Plantes	*Ann. Amélior. Pl., Paris*
Annales de l'École Nationale d'Agriculture de Montpellier (2)	*Ann. Éc. Agric. Montpellier*
Annales des Épiphyties. Paris (7)	*Ann. Épiphyt., Paris*
Annales de l'Institut National Agronomique (8)	*Ann. Inst. nat. agron., Paris*
Annales de Physiologie végétale. Paris	*Ann. Physiol. vég., Paris*
Annales des Sciences Naturelles. Botanique et Biologie Végétale (5)	*Ann. Sci. nat. Bot. Biol. vég.*
Annales Scientifiques de l'Université de Besançon. Série 2. [Botanique] (7)	*Ann. sci. Univ. Besançon* (2)
Année Biologique (7)	*Année biol.*
Bulletin Agronomique du Ministère de la France d'Outre-mer	*Bull. agron. Fr. d'out. mer*
Bulletin de la Fédération Française d'Économie Alpestre	*Bull. Féd. franç. Écon. alp.*
Bulletin du Muséum National d'Histoire Naturelle. Paris (7)	*Bull. Mus. Hist. nat., Paris*
Bulletin du Service de la Carte Phytogéographique. Séries A et B	*Bull. Serv. Carte phytogéog.* (*A*) (*B*)
Bulletin de la Société Botanique de France (7)	*Bull. Soc. bot. Fr.*
Bulletin de la Société Française de Physiologie végétale	*Bull. Soc. franç. Physiol. vég.*
Bulletin Technique d'Information (8)	*Bull. tech. Inform.*
Comptes Rendus Hebdomadaires des Séances de l'Académie d'Agriculture de France	*C.R. Acad. Agric. Fr.*
Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences. Paris (7)	*C.R. Acad. Sci., Paris*
Comptes Rendus des Séances de la Société de Biologie. Paris (7)	*C.R. Soc. Biol., Paris*
Coton et Fibres Tropicales	*Cot. et Fibr. trop.*
Fourrages	*Fourrages*
Journal d'Agriculture Tropicale et de Botanique Appliquée	*J. Agric. trop. et Bot. appl.*
Oléagineux	*Oléagineux*
Pomme de Terre Française	*Pomme d. Terre franç.*
Potasse	*Potasse*
Rapport de l'Institut de Recherches du Coton et des Textiles Exotiques [Cont. in *Cot. et Fibr. trop.*]	*Rapp. I.R.C.T.*
Rapport de la Société d'Encouragement de la Culture des Orges de Brasserie et des Houblons en France	*Rapp. SECOBRAH*
Revue d'Élevage et de Médicine Vétérinaire des Pays Tropicaux (7)	*Rev. Élev.*
Revue Générale de Botanique. Paris (7)	*Rev. gén. Bot.*
Riz et Riziculture	*Riz et Rizicult.*
GERMANY (EAST AND WEST)	
Albrecht-Thaer-Archiv (3)	*Albr.-Thaer-Arch.*
Angewandte Botanik (2)	*Angew. Bot.*
Angewandte Chemie (5)	*Angew. Chem.*
Angewandte Pflanzensoziologie Stolzenau/Weser	*Angew. PflSoziol.*
Bayerisches Landwirtschaftliches Jahrbuch	*Bayer. landw. Jahrb.*
Beiträge zur Biologie der Pflanzen (5)	*Beitr. Biol. Pfl.*
Bericht über die Tätigkeit des Instituts für Grünlandwirtschaft, Braunschweig-Völkenrode (8)	*Ber. Inst. Grünlandwirtsch., Braunschweig-Völkenrode*
Bericht über die Tätigkeit des Instituts für Pflanzenbau und Saatguterzeugung der Forschungsanstalt für Landwirtschaft, Braunschweig-Völkenrode	*Ber. Inst. PflBau Saatgut., Braunschweig-Völkenrode*
Berichte der Deutschen Botanischen Gesellschaft (5)	*Ber. dtsch. bot. Ges.*

Title	Abbreviation used

GERMANY—(*Continued*)

Berichte und Vorträge der Deutschen Akademie der Landwirtschafts-wissenschaften zu Berlin	*Ber. u. Vortr. dtsch. Akad. LandwWiss.*
Biologisches Zentralblatt (2)	*Biol. ZBl.*
Botanische Jahrbücher. Stuttgart (5)	*Bot. Jahrb., Stuttgart*
Deutsche Landwirtschaft (3)	*Dtsch. Landw.*
Deutsche Landwirtschaftliche Presse	*Dtsch. landw. Pr.*
Flora. Jena (5)	*Flora, Jena*
Futterkonservierung	*Futterkonservierung*
Futter und Fütterung (13)	*Futter u. Fütterung*
Gesunde Pflanzen (5)	*Gesunde Pflanzen*
Grünland (13)	*Grünland*
Jahrbuch der Deutschen Akademie der Landwirtschafts-wissenschaften zu Berlin (8)	*Jahrb. dtsch. Akad. LandwWiss.*
Kartoffelbau	*Kartoffelbau*
Kühn-Archiv	*KühnArchiv*
Landbauforschung, Völkenrode	*LandbForsch., Völkenrode*
Landwirtschaft-Angewandte Wissenschaft	*Landw.-ang. Wiss.*
Landwirtschaftliche Forschung	*Landw. Forsch.*
Mitteilungen der Bayerischen Landesanstalt für Tierzucht in Grub (8)	*Mitt. bayer. Landesanst. Tierzucht Grub*
Mitteilungen aus der Biologischen Bundesanstalt für Land- und Forstwirtschaft. Berlin-Dahlem	*Mitt. biol. Bundesanst. Berl.*
Mitteilungen für Landkultur, Moor- und Torfwirtschaft	*Mitt. Landk., Moor- u. Torfwirtsch.*
Nachrichtenblatt des Deutschen Pflanzenschutzdienstes. Braunschweig (10)	*NachrBl. dtsch. PflSchDienst., Braunschweig*
Naturwissenschaften (5)	*Naturwissenschaften*
Planta. Archiv für wissenschaftliche Botanik (5)	*Planta*
Praktische Blätter für Pflanzenbau und Pflanzenschutz	*Prakt. Bl. PflBau*
Saatgut-Wirtschaft (3)	*Saatgut-Wirtsch.*
Schriftenreihe der Landwirtschaftlichen Fakultät der Universität Kiel	*SchrReihe landw. Fak. Univ. Kiel*
Sitzungsberichte der Deutschen Akademie der Landwirtschafts-wissenschaften zu Berlin	*S.B. dtsch. Akad. LandwWiss.*
Zeitschrift für Acker- und Pflanzenbau	*Z. Acker-u. PflBau*
Zeitschrift für Botanik (5)	*Z. Bot.*
Zeitschrift für Landwirtschaftliches Versuchs- und Untersuchungs-wesen (3)	*Z. landw. Vers- u. UntersuchWes.*
Zeitschrift für Pflanzenernährung, Düngung, Bodenkunde	*Z. PflErnähr. Düng.*
Zeitschrift für Pflanzenkrankheiten (Pflanzenpathologie) und Pflanzenschutz(2)	*Z. PflKrankh.*
Zeitschrift für Pflanzenzüchtung (10)	*Z. PflZücht.*
Züchter (2)	*Züchter*

GREAT BRITAIN

Advancement of Science	*Advanc. Sci.*
Agricultural and Horticultural Engineering Abstracts	*Agric. hort. Engng Abstr.*
Agricultural History Review (8)	*Agric. Hist. Rev.*
Agricultural Merchant	*Agric. Merch.*
Agricultural Progress	*Agric. Progr.*
Agriculture. London	*Agriculture, Lond.*
Analyst. London (8)	*Analyst, Lond.*
Analytical Abstracts	*Analyt. Abstr.*
Animal Behaviour (8)	*Anim. Behav.*
Animal Production	*Anim. Prod.*
Annals of Applied Biology (8)	*Ann. appl. Biol.*
Annals of Botany (8)	*Ann. Bot., Lond.*
Aslib Book List	*Aslib Bk List*

Title	Abbreviation used
GREAT BRITAIN—(*Continued*)	
Biochemical Journal (8)	*Biochem. J.*
Biological Reviews (8)	*Biol. Rev.*
British Journal of Applied Physics (8)	*Brit. J. appl. Phys.*
British Journal of Nutrition (8)	*Brit. J. Nutr.*
British Sugar Beet Review	*Brit. Sug. Beet Rev.*
British Veterinary Journal (8)	*Brit. vet. J.*
Bulletin of Entomological Research	*Bull. ent. Res.*
Bulletin of the Surrey Grassland Society	*Bull. Surrey Grassl. Soc.*
Chemistry and Industry (8)	*Chem. and Industr.*
Commonwealth Development	*Commonw. Devel.*
Commonwealth Phytopathological News	*Commonw. phytopath. News*
Countryman	*Countryman*
Dairy Farmer	*Dairy Fmr*
Dairy Science Abstracts	*Dairy Sci. Abstr.*
Digest of Agricultural Economics	*Dig. agric. Econ.*
Discovery (8)	*Discovery*
East Anglian Farming World	*E. Anglian Fmg World*
Empire Cotton Growing Review	*Emp. Cott. Gr. Rev.*
Empire Journal of Experimental Agriculture	*Emp. J. exp. Agric.*
Endeavour	*Endeavour*
Experimental Horticulture	*Exp. Hortic.*
Experimental Husbandry (8)	*Exp. Husb.*
Farm Implement and Machinery Review (8)	*Fm Impl. Rev.*
Farm Mechanization	*Fm Mechaniz.*
Farm Review	*Fm Rev.*
Farmer and Stock-Breeder	*Fmr and Stk-Breed.*
Farmer's Weekly	*Fmr's Wkly, Lond.*
Farming Review (8)	*Fmg Rev.*
Forestry Abstracts	*For. Abstr.*
Geographical Journal (7)	*Geogr. J.*
Helminthological Abstracts	*Helminth. Abstr.*
Heredity (7)	*Heredity*
Horticultural Abstracts	*Hort. Abstr.*
Index to theses accepted for higher degrees in the Universities of Great Britain and Ireland (Aslib)	*Index to Theses, Aslib*
Journal and Proceedings of the Institution of Agricultural Engineers	*J. Proc. Inst. agric. Engnrs*
Journal of Agricultural Economics	*J. agric. Econ.*
Journal of Agricultural Engineering Research (8)	*J. agric. Engng Res.*
Journal of Agricultural Science (8)	*J. agric. Sci.*
Journal of the Agricultural Society, University College of Wales	*J. agric. Soc. Univ. Coll. Wales*
Journal of the Association of Green Crop Driers (8)	*J. Ass. Green Crop Driers*
Journal of the British Grassland Society	*J. Brit. Grassl. Soc.*
Journal of the Chartered Land Agents' Society	*J. Chartered Land Agents' Soc.*
Journal of Dairy Research	*J. Dairy Res.*
Journal of Documentation (8)	*J. Document.*
Journal of the Durham School of Agriculture, Houghall	*J. Durham Sch. Agric.*
Journal of Ecology (8)	*J. Ecol.*
Journal of Experimental Botany	*J. exp. Bot.*
Journal of the Farmers' Club. London	*J. Fmrs' Cl., Lond.*
Journal of General Microbiology (8)	*J. gen. Microbiol.*
Journal of Genetics (7)	*J. Genet.*
Journal of Helminthology (8)	*J. Helminth.*
Journal of Horticultural Science (8)	*J. hort. Sci.*
Journal of the Institute of Brewing (11)	*J. Inst. Brew.*
Journal of the Institute of Corn and Agricultural Merchants, Ltd.	*J. Inst. corn agric. Merch.*
Journal of the National Institute of Agricultural Botany	*J. nat. Inst. agric. Bot.*
Journal of the Royal Agricultural Society	*J. R. agric. Soc.*
Journal of the Royal Horticultural Society (8)	*J. R. hort. Soc.*

Title	Abbreviation used
GREAT BRITAIN—(*Continued*)	
Journal of the Royal Society of Arts (8)	*J. R. Soc. Arts*
Journal of the Science of Food and Agriculture (8)	*J. Sci. Fd Agric.*
Journal of Scientific Instruments (8)	*J. sci. Instrum.*
Journal of Soil Science	*J. Soil Sci.*
Journal of the Sports Turf Research Institute (8)	*J. Sports Turf Res. Inst.*
Journal of the Yorkshire Grassland Society (8)	*J. Yorks. Grassl. Soc.*
Kew Bulletin (8)	*Kew Bull.*
Laboratory Practice (8)	*Lab. Prac.*
LLU Translations Bulletin	*LLU Transl. Bull.*
Meteorological Bibliography. Harrow	*Met. Bibl., Harrow*
Meteorological Magazine. London (8)	*Met. Mag., Lond.*
Monthly Information Sheet. British Standards Institution (8)	*Mon. Inform. Sh. Brit. Stand. Inst.*
Monthly Report of the Ministry of Agriculture. Northern Ireland	*Mon. Rep. Minist. Agric. N. Ire.*
National Farmers' Union Information Service (8)	*N.F.U. Inform. Serv.*
Nature (8)	*Nature, Lond.*
New Commonwealth	*New Commonw.*
New Phytologist (8)	*New Phytol.*
New Scientist	*New Scient.*
Notes from the Royal Botanic Garden. Edinburgh (2)	*Notes R. bot. Gdn, Edinb.*
Nutrition Abstracts and Reviews	*Nutr. Abstr. Rev.*
Outlook on Agriculture	*Outlook on Agric.*
Pest Infestation Research (8)	*Pest Infest. Res.*
Pest Technology (2)	*Pest Technol.*
Pesticide Abstracts and News Summary. Section C	*Pest. Abstr. (C)*
Plant Breeding Abstracts	*Pl. Breed. Abstr.*
Plant Pathology	*Pl. Path.*
Practical Power Farming. London	*Prac. Pwr Fmg, Lond.*
Proceedings of the Botanical Society of the British Isles (8)	*Proc. bot. Soc. Brit. Is*
Proceedings of the British Weed Control Conference	*Proc. Brit. Weed Contr. Conf.*
Proceedings of the Nutrition Society (8)	*Proc. Nutr. Soc.*
Proceedings of the Royal Society. London. Series B (8)	*Proc. roy. Soc. (B)*
Proceedings of the Royal Society of Edinburgh. Section B (7)	*Proc. roy. Soc. Edinb. (B)*
Progress. London	*Progress, Lond.*
Progress Reports from Experiment Stations. Empire Cotton Growing Corporation	*Progr. Reps Exp. Stas Emp. Cott. Gr. Corp.*
Quarterly Journal of the Royal Meteorological Society (2)	*Quart. J. R. met. Soc.*
Quarterly Review. National Agricultural Advisory Service	*Quart. Rev. N.A.A.S.*
Quarterly Review of the Royal Agricultural Society of England	*Quart. Rev. R. agric. Soc. Engl.*
Report and Accounts of the National Institute of Agricultural Botany	*Rep. Accts nat. Inst. agric. Bot.*
Report of the Agricultural and Horticultural Research Station. University of Bristol. Long Ashton	*Rep. agric. hort. Res. Sta. Long Ashton*
Report of the Agricultural Improvement Council for England and Wales	*Rep. agric. Improve. Coun.*
Report of the Agricultural Research Council	*Rep. agric. Res. Coun.*
Report of the Agricultural Research Institute of Northern Ireland	*Rep. agric. Res. Inst. N. Ire.*
Report of the Aynsome Laboratories Ltd.	*Rep. Aynsome Labs*
Report of the Colonial Development Corporation	*Rep. Colon. Devel. Corp.*
Report of the Colonial Products Council	*Rep. Colon. Prod. Coun.*
Report of the Committee for Colonial Agriculture, Animal Health and Forestry Research	*Rep. Cttee Col. Agric., anim. Hlth, for. Res.*
Report of the Commonwealth Agricultural Bureaux Executive Council. Farnham Royal	*Rep. Commonw. agric. Bur., Farnham Royal*
Report of the Department of Hop Research. Wye College	*Rep. Dep. Hop Res., Wye Coll.*
Report of the Directorate of Colonial (Geodetic and Topographical) Surveys	*Rep. Dir. colon. Survs*
Report of the East Malling Research Station (8)	*Rep. E. Malling Res. Sta.*

Title	Abbreviation used
GREAT BRITAIN—(*Continued*)	
Report of the Edinburgh and East of Scotland College of Agriculture	*Rep. Edinb. Coll. Agric.*
Report of the Food Investigation Board	*Rep. Fd Invest. Bd*
Report of the Glasgow and West of Scotland Agricultural College	*Rep. W. Scot. agric. Coll.*
Report of the Glasshouse Crops Research Institute	*Rep. Glasshouse Crops Inst.*
Report of the Grassland Research Institute. Hurley	*Rep. Grassl. Res. Inst., Hurley*
Report of the Hannah Dairy Research Institute	*Rep. Hannah Dairy Inst.*
Report of the Imperial Forestry Institute. Oxford	*Rep. imp. for. Inst. Oxf.*
Report of the John Innes Horticultural Institution (8)	*Rep. Innes hort. Instn*
Report of the Macaulay Institute for Soil Research	*Rep. Macaulay Inst. Soil Res.*
Report on the National Agricultural Advisory Service	*Rep. N.A.A.S.*
Report of the National Institute of Agricultural Botany. Cambridge	*Rep. nat. Inst. agric. Bot., Camb.*
Report of the National Institute of Agricultural Engineering (8)	*Rep. N.I.A.E.*
Report of the National Institute for Research in Dairying. Reading University (8)	*Rep. nat. Inst. Dairy., Reading*
Report of the National Vegetable Research Station. Wellesbourne, Warwick	*Rep. nat. veg. Res. Sta., Warwick*
Report of the Nature Conservancy	*Rep. Nat. Conserv.*
Report of the Norfolk Agricultural Station	*Rep. Norfolk agric. Sta.*
Report of the Nottingham University School of Agriculture (8)	*Rep. Nottingham Univ. Sch. Agric.*
Report of the Pea-growing Research Organization Ltd.	*Rep. Pea-growing Res. Org. Ltd.*
Report of the Principal to the Governing Body. Wye College	*Rep. Gov. Body, Wye Coll.*
Report of the Production Division, Milk Marketing Board (8)	*Rep. Prod. Div., Milk Mktg Bd*
Report of the Rothamsted Experiment Station	*Rep. Rothamsted exp. Sta.*
Report of the Scottish Society for Research in Plant Breeding	*Rep. Scot. Soc. Res. Pl. Breed.*
Report of the States Experimental Station. Jersey	*Rep. States exp. Sta., Jersey*
Report of the Welsh Plant Breeding Station	*Rep. Welsh Pl. Breed. Sta.*
Report of Trial and Experimental Work. Throws, Little Dunmow	*Rep. exp. Wk, Throws*
Research Applied in Industry. London (2)	*Research appl. Industr., Lond.*
Research and Experimental Record of the Ministry of Agriculture. Northern Ireland	*Res. exp. Rec. Minist. Agric. N. Ire.*
Review of Applied Entomology	*Rev. appl. Ent.*
Review of Applied Mycology	*Rev. appl. Mycol.*
Scientific Horticulture	*Sci. Hort.*
Scottish Agriculture	*Scot. Agric.*
Soils and Fertilizers	*Soils and Ferts*
Span (Shell)	*Span*
Times Review of British Colonies (8)	*Times Rev. Brit. Colon.*
Times Review of Science (8)	*Times Rev. Sci.*
Transactions and Proceedings of the Botanical Society of Edinburgh (7)	*Trans. bot. Soc. Edinb.*
Transactions of the Royal Highland and Agricultural Society of Scotland	*Trans. R. Highl. agric. Soc. Scot.*
Tropical Science	*Trop. Sci.*
Veterinary Bulletin. Weybridge (8)	*Vet. Bull., Weybridge*
Veterinary Record (8)	*Vet. Rec.*
Veterinary Reviews and Annotations (8)	*Vet. Rev. Annot.*
Watsonia (8)	*Watsonia*
Weather	*Weather*
Weed Abstracts	*Weed Abstr.*
World Crops	*World Crops*
GREECE	
Report of the Hellenic Agricultural Research Station	*Rep. Hellen. agric. Res. Sta.*
HAWAII	
Pacific Science. Hawaii (4)	*Pacif. Sci., Hawaii*
Report of the Agricultural Experiment Station. Hawaii	*Rep. agric. Exp. Sta., Hawaii*

Title	Abbreviation used
HONG KONG	
Report of the Department of Agriculture, Fisheries and Forestry. Hong Kong	*Rep. Dep. Agric. Fish. For. Hong Kong*
HUNGARY	
Acta Agronomica Hungarica	*Acta agron. hung.*
Acta Biologica Hungarica	*Acta biol. hung.*
Agrokémia és Talajtan	*Agrokémia és Talaj.*
Kisérletugyi Közlemények	*Kisérl. Közl.*
Növénytermelés	*Növénytermelés*
Yearbook of the National Institute for Agricultural Quality Research. Budapest	*Yearb. nat. Inst. agric. Qual. Res.*
INDIA	
Agra University Journal of Research (Science) (6)	*Agra Univ. J. Res. (Sci.)*
Andhra Agricultural Journal	*Andhra agric. J.*
Annual Administration Report of Agriculture and Animal Husbandry Departments, Uttar Pradesh College of Veterinary Science	*Annu. admin. Rep. Agric. Anim. Husb. Dep. Uttar Pradesh*
Annual Administration Report, State Department of Agriculture, Uttar Pradesh	*Annu. admin. Rep. State Dep. Agric. Uttar Pradesh*
Bulletin of the Botanical Society of Bengal (7)	*Bull. bot. Soc. Beng.*
Central Board of Irrigation Abstracts	*Cent. Bd Irrig. Abstr.*
Current Science	*Curr. Sci.*
Farmer. Bombay	*Farmer, Bombay*
Indian Agriculturist	*Indian Agric.*
Indian Cotton Growing Review	*Indian Cott. Gr. Rev.*
Indian Farming	*Indian Fmg*
Indian Journal of Agricultural Science	*Indian J. agric. Sci.*
Indian Journal of Agronomy	*Indian J. Agron.*
Indian Journal of Genetics and Plant Breeding	*Indian J. Genet.*
Indian Journal of Plant Physiology	*Indian J. Pl. Physiol.*
Indian Journal of Veterinary Science and Animal Husbandry	*Indian J. vet. Sci.*
Indian Oilseeds Journal	*Indian Oilseeds J.*
Indian Phytopathology (7)	*Indian Phytopath.*
Indian Veterinary Journal (9)	*Indian vet. J.*
INSDOC List of Current Scientific Literature	*INSDOC List curr. sci. Lit.*
Journal of Biological Science	*J. biol. Sci.*
Journal of the Indian Botanical Society (7)	*J. Indian bot. Soc.*
Journal of the Indian Society of Soil Science	*J. Indian Soc. Soil Sci.*
Journal of Scientific Research. Banaras Hindu University	*J. sci. Res., Banaras*
Journal of Soil and Water Conservation in India	*J. Soil Wat. Conserv., India*
Journal of the University of Bombay. Section B (3)	*J. Univ. Bombay (B)*
Madras Agricultural Journal	*Madras agric. J.*
Mysore Agricultural Journal	*Mysore agric. J.*
Phytomorphology (8)	*Phytomorphology*
Plant Protection Bulletin	*Pl. Prot. Bull.*
Poona Agricultural College Magazine (3)	*Poona agric. Coll. Mag.*
Proceedings of the Indian Academy of Sciences. Part B (3)	*Proc. Indian Acad. Sci. (B)*
Proceedings of the National Institute of Sciences. India. Part B	*Proc. nat. Inst. Sci. India (B)*
Report of the Bose Research Institute (8)	*Rep. Bose Res. Inst.*
Report of the Central Rice Research Institute. Cuttack	*Rep. Rice Res. Inst., Cuttack*
Report of the Indian Central Cotton Committee	*Rep. Indian Cott. Cttee*
Report of the Indian Central Jute Committee	*Rep. Indian Jute Cttee*
Report of the Indian Council of Agricultural Research. New Delhi	*Rep. Indian Coun. agric. Res., New Delhi*

Title	Abbreviation used
INDIA—(*Continued*)	
Report of the Institute of Plant Industry. Indore	*Rep. Inst. Pl. Industr., Indore*
Rice News Teller	*Rice News Tell.*
Science and Culture	*Sci. and Cult.*
Technical Bulletin of the Bureau of Agricultural Information. Uttar Pradesh	*Tech. Bull. Bur. agric. Inf., Uttar Pradesh*
Transactions of the Bose Research Institute (8)	*Trans. Bose Res. Inst.*
INDONESIA	
Annales Bogorienses (7)	*Ann. bogor.*
Indonesian Abstracts	*Indonesian Abstr.*
Menara Perkebunan	*Menara Perkebunan*
INTERNATIONAL	
Arid Zone U.N.E.S.C.O. (8)	*Arid Zone U.N.E.S.C.O.*
FAO Plant Protection Bulletin	*FAO Plant Prot. Bull.*
Fatis Review (O.E.E.C.)	*Fatis Rev.*
Fibra	*Fibra*
International Journal of Applied Radiation and Isotopes (8)	*Internat. J. Appl. Rad. Isot.*
International Rice Commission News Letter (F.A.O.)	*Internat. Rice Comm. News Lett.*
Proceedings of the International Grassland Congress	*Proc. internat. Grassl. Cong.*
Proceedings of the International Seed Testing Association	*Proc. internat. Seed Test. Ass.*
Quarterly Bulletin of the International Association of Agricultural Librarians and Documentalists	*Quart. Bull. internat. Ass. agric. Librns Documents*
Report of the Barley Committee. European Brewery Convention	*Rep. Barley Cttee. Europ. Brew. Conv.*
Report of the International Crop Improvement Association	*Rep. internat. Crop Improve. Ass.*
Report of the International Institute for Land Reclamation and Improvement	*Rep. internat. Inst. Ld Reclam. Improve.*
U.N.E.S.C.O. Bulletin for Libraries	*U.N.E.S.C.O. Bull. Lib.*
IRELAND, REPUBLIC OF	
Agricultural Ireland (8)	*Agric. Ire.*
Economic Proceedings of the Royal Dublin Society	*Econ. Proc. R. Dublin Soc.*
Journal of the Department of Agriculture. Republic of Ireland	*J. Dep. Agric. Republ. Ire.*
Notes from the Botanical School of Trinity College, Dublin (7)	*Notes bot. Sch. Trin. Coll., Dublin*
Report of the Minister for Agriculture. Republic of Ireland	*Rep. Minist. Agric. Republ. Ire.*
Scientific Proceedings of the Royal Dublin Society	*Sci. Proc. R. Dublin Soc.*
ISRAEL	
Bulletin of the Research Council. Israel. Section B. Biology and Geology	*Bull. Res. Coun. Israel (B)*
Bulletin of the Research Council. Israel. Section D. Botany	*Bull. Res. Coun. Israel (D)*
Ktavim. Records of the Agricultural Research Station. Israel	*Ktavim, Israel*
ITALY	
Agricoltura delle Venezie (3)	*Agricoltura d. Venezie*
Allionia (7)	*Allionia*
Annali di Botanica. Roma (12)	*Ann. Bot., Roma*
Annali della Facoltà di Agraria. Università di Bari	*Ann. Fac. Agr., Bari*
Annali della Facoltà di Agraria. Università di Milano	*Ann. Fac. Agr., Milano*
Annali della Facoltà di Agraria. Università di Perugia (3)	*Ann. Fac. Agr., Perugia*
Annali della Facoltà di Agraria. Università del S. Cuore. Milano	*Ann. Fac. Agr., S. Cuore*
Annali della Sperimentazione Agraria	*Ann. Sper. agr.*
Annali della Stazione Chimico-Agraria Sperimentale di Roma	*Ann. Sta. chim.-agr., Roma*
Annali della Stazione Sperimentale di Risicoltura. Vercelli	*Ann. Sta. sper. Risicolt., Vercelli*

Title	Abbreviation used
ITALY—(*Continued*)	
Atti del Centro Nazionale Meccanico Agricolo. Torino	*Atti Cent. naz. mecc. agric., Torino*
Genetica Agraria (3)	*Genet. agr.*
Giornale di Agricoltura della Domenica	*G. Agric. Domen.*
Industria Saccarifera Italiana	*Industr. saccar. ital.*
Italia Agricola	*Ital. agric.*
Maydica	*Maydica*
Nuovo Giornale Botanico Italiano	*Nuovo G. bot. ital.*
Progresso agricolo (2)	*Progresso agric.*
Rapporto della Stazione Sperimentale Agraria di Bari	*Rapp. Sta. sper. agr., Bari*
Rapporto della Stazione Sperimentale di Bieticoltura di Rovigo	*Rapp. Sta. sper. Bieticolt., Rovigo*
Rapporto della Stazione Sperimentale di Granicoltura di Catania	*Rapp. Sta. sper. Granicolt., Catania*
Rapporto della Stazione Sperimentale di Praticoltura di Lodi	*Rapp. Sta. sper. Praticolt., Lodi*
Ricerca Scientifica	*Ric. sci.*
Riso	*Riso*
Rivista di Agricoltura Subtropicale e Tropicale (2)	*Riv. Agric. subtrop.*
Rivista di Zootecnia. Milano (1)	*Riv. Zootec., Milano*
Sementi Elette	*Sementi elette*
Tecnica agricola	*Tecnica agric.*
Webbia (7)	*Webbia*
JAPAN	
Annals of the Phytopathological Society of Japan (10)	*Ann. phytopath. Soc. Japan*
Berichte des Ohara Instituts für Landwirtschaftliche Biologie	*Ber. Ohara Inst.*
Botanical Magazine. Tokyo (10)	*Bot. Mag., Tokyo*
Bulletin of the Division of Plant Breeding and Cultivation, Tokai-Kinki National Agricultural Experiment Station	*Bull. Div. Pl. Breed. Cult., Tokai-Kinki*
Bulletin of the Faculty of Agriculture. Hirosaki University (2)	*Bull. Fac. Agric., Hirosaki*
Bulletin of the Faculty of Agriculture. Kagoshima University (8)	*Bull. Fac. Agric., Kagoshima*
Bulletin of the Faculty of Agriculture. Miyazaki University	*Bull. Fac. Agric., Miyazaki*
Bulletin of the Faculty of Agriculture, Shinshu University (3)	*Bull. Fac. Agric., Shinshu*
Bulletin of the Faculty of Agriculture. Shizuoka University	*Bull. Fac. Agric., Shizuoka*
Bulletin of the Faculty of Agriculture. Yamaguti University	*Bull. Fac. Agric., Yamaguti*
Bulletin of the National Institute of Agricultural Sciences. Nishigahara	*Bull. nat. Inst. agric. Sci., Nishigahara*
Bulletin of the University of Osaka Prefecture. Series B	*Bull. Univ. Osaka (B)*
Bulletin of the Yamagata University (Agricultural Science) (3)	*Bull. Yamagata Univ. (Agric. Sci.)*
Japanese Journal of Botany (5)	*Japan. J. Bot.*
Journal of the Faculty of Agriculture. Iwate University (5)	*J. Fac. Agric., Iwate*
Journal of the Faculty of Agriculture. Kyushu University (8)	*J. Fac. Agric., Kyushu*
Journal of the Faculty of Agriculture. Shinshu University (3)	*J. Fac. Agric., Shinshu*
Journal of the Faculty of Agriculture. Tottori University	*J. Fac. Agric., Tottori*
Journal of the Faculty of Science, Hokkaido University, Series Botany	*J. Fac. Sci., Hokkaida Univ., Ser. Bot.*
Journal of the Horticultural Association of Japan (2)	*J. hort. Ass. Japan*
Journal of the Kanto-Tosan Agricultural Experiment Station	*J. Kanto-Tosan agric. Exp. Sta.*
Memoirs of the Ehime University. Section 6 (8)	*Mem. Ehime Univ. (6)*
Memoirs of the Faculty of Agriculture. Kagoshima University (8)	*Mem. Fac. Agric., Kagoshima*
Memoirs of the Faculty of Agriculture. Miyazaki University	*Mem. Fac. Agric., Miyazaki*
Memoirs of the Hyogo Prefectural University of Agriculture (8)	*Mem. Hyogo Prefect. Univ. Agric.*
Proceedings of the Crop Science Society of Japan	*Proc. Crop Sci. Soc. Japan*
Proceedings of the Japan Academy (8)	*Proc. Japan Acad.*
Records of Researches, Faculty of Agriculture. Tokyo University	*Rec. Res. Fac. Agric., Tokyo*
Report of the Hokkaido National Agricultural Experiment Station	*Rep. Hokkaido nat. agric. Exp. Sta.*
Research Bulletin of the Hokkaido National Agricultural Experiment Station	*Res. Bull. Hokkaido nat. agric. Exp. Sta.*
Science Bulletin of the Faculty of Agriculture. Kyushu University (8)	*Sci. Bull. Fac. Agric., Kyushu*
Science Reports of Hyogo University of Agriculture (8)	*Sci. Reps Hyogo Univ. Agric.*

Title	Abbreviation used
JAPAN—(*Continued*)	
Science Reports of the Research Institutes. Tôhoku University. Series D	*Sci. Reps Res. Inst. Tôhoku (D)*
Scientific Reports of the Faculty of Agriculture, Meijo University	*Sci. Reps Fac. Agric., Meijo Univ.*
Soil and Plant Food	*Soil Pl. Fd*
Technical Bulletin of the Kagawa Agricultural College	*Tech. Bull. Kagawa agric. Coll.*
Tôhoku Journal of Agricultural Research	*Tôhoku J. agric. Res.*
Transactions of the Tottori Society of Agricultural Science	*Trans. Tottori Soc. agric. Sci.*
MADAGASCAR	
Bulletin de Madagascar	*Bull. Madagascar*
MALAYA, FEDERATION OF	
Garden's Bulletin. Singapore (7)	*Gdn's Bull.*
Malayan Agricultural Journal	*Malay. agric. J.*
Malayan Journal of Tropical Geography (7)	*Malay. J. trop. Geogr.*
Report of the Botanical Gardens, Department of Agriculture. Singapore	*Rep. bot. Gdns, Dep. Agric., Singapore*
Report of the Department of Agriculture. Malaya	*Rep. Dep. Agric. Malaya*
MAURITIUS	
Report of the Department of Agriculture. Mauritius	*Rep. Dep. Agric. Mauritius*
Revue Agricole et Sucrière de l'Île Maurice (2)	*Rev. agric. suc. Maurice*
Report of the Mauritius Institute	*Rep. Mauritius Inst.*
Report of the Sugar Industry Research Institute. Mauritius	*Rep. Sug. Industr. Res. Inst. Mauritius*
NETHERLANDS	
Acta Botanica Néerlandica. Amsterdam (7)	*Acta bot. néerl.*
Antonie van Leeuwenhoek ; Nederlandsch Tijdschrift voor Hygiëne, Microbiologie en Serologie (7)	*Leeuwenhoek ned. Tijdschr.*
Biochimica et Biophysica Acta (7)	*Biochim. biophys. Acta*
Blumea (7)	*Blumea*
Entomologia Experimentalis et Applicata (8)	*Ent. exp. et appl.*
Euphytica	*Euphytica*
European Potato Journal	*Europ. Potato J.*
Jaarboek. Instituut voor Biologisch en Scheikundig Onderzoek van Landbouwgewassen	*Jaarb. Inst. Biol. Scheik. Onderz. LandbGew.*
Jaarboekje van het Nationaal Comité voor Brouwgerst	*Jaarb. NaCoBrouw.*
Jaarboekje van de Stichting Nederlands Graan-Centrum	*Jaarb. Ned. Graan-Centrum*
Jaarverslag. Centrum voor Plantenfysiologisch Onderzoek	*Jaarversl. Cent. Plantenfysiol. Onderz.*
Jaarverslag. Instituut voor Biologisch en Scheikundig Onderzoek van Landbouwgewassen	*Jaarversl. Inst. Biol. Scheik. Onderz. LandbGew.*
Jaarverslag. Instituut voor Cultuurtechniek en Waterhuishouding	*Jaarversl. Inst. CultTech. Waterhuis.*
Jaarverslag. Instituut voor Landbouwtechniek en Rationalisatie	*Jaarversl. Inst. LandbTech. Rational.*
Jaarverslag. Landbouw-Economisch Instituut	*Jaarversl. Landb.-Econ. Inst.*
Jaarverslag. Nederlandse Algemene Keuringsdienst	*Jaarversl. ned. Keuringsd.*
Jaarverslag. Stichting C.L.O.-Contrôle (8)	*Jaarversl. Sticht. C.L.O.-Contr.*
Landbouwdocumentatie	*LandbDocum.*
Landbouwkundig Tijdschrift. Wageningen	*Landbouwk. Tijdschr., Wageningen*
Landbouwmechanisatie	*LandbMechanisatie*
Landbouwvoorlichting	*LandbVoorl.*
Mededeelingen van het Botanisch Museum en Herbarium van de Rijks-Universiteit te Utrecht (7)	*Meded. bot. Mus. Rijksuniv. Utrecht*
Mededelingen van het Instituut voor Rationele Suikerproductie	*Meded. Inst. rat. Suikerprod.*
Mededelingen van de Landbouwhogeschool te Wageningen	*Meded. LandbHogesch., Wageningen*

Title	Abbreviation used
NETHERLANDS—(*Continued*)	
Mededeelingen. Nationale Coöperatieve Aan- en Verkoopvereniging voor de Landbouw " Centraal Bureau " G.A.	*Meded. nat. coöp. Aan- en Verkoopv. Landb. Cent. Bur.*
Mededelingen van de Nederlandse Algemene Keuringsdienst voor Landbouwzaden en Aardappelpootgoed	*Meded. ned. Keuringsd.*
Nematologica (8)	*Nematologica*
Netherlands Journal of Agricultural Science	*Neth. J. agric. Sci.*
Plant and Soil (8)	*Plant and Soil*
Potato News from the Netherlands	*Pot. News Neths*
Qualitas Plantarum et Materiae Vegetabiles (2)	*Qual. Plant. et Materiae veg.*
Rapport van de Commissie ter Bevordering der Suikerbietenteelt in de Noordelijke Provinciën [Cont. in *Meded. Inst. rat. Suikerprod.*]	*Rapp. Comm. Bevord. Suikerbiet. Noord. Prov.*
Stikstof	*Stikstof*
Stikstof. Dutch Nitrogenous Fertilizer Review	*Stikstof. Eng. edn*
Suikerbiet	*Suikerbiet*
Technische Berichten Peulvruchten Studie Combinatie	*Tech. Ber. Peulvrucht.*
Tijdschrift over Planteziekten (2)	*Tijdschr. PlZiekt.*
Tijdschrift voor Economische en Sociale Geografie	*Tijdschr. econ. soc. Geog.*
TNO Nieuws	*TNO Nieuws*
Tropical Abstracts	*Trop. Abstr.*
V.C.S. Bode	*V.C.S. Bode*
Vegetatio, Acta Geobotanica. Haag	*Vegetatio, Haag*
Verslagen van Landbouwkundige Onderzoekingen	*Versl. landbouwk. Onderz.*
Verslag. Instituut voor Bewaring en Verwerking van Landbouwprodukten	*Versl. Inst. Bewar. Verwerk. LandbProd.*
Verslag. Instituut voor Bodemvruchtbaarheid. Groningen	*Versl. Inst. Bodemvrucht., Groningen*
Verslag. Peulvruchten Studie Combinatie	*Versl. Peulvrucht.*
Verslag. Proefstation voor de Akker- en Weidebouw	*Versl. Proefst. Akker. Weidebouw*
Verslag. Rijkslandbouwproefstation. Groningen	*Versl. RijkslandbProefst., Groningen*
Verslag. Tienjarenplan voor Graanonderzoek	*Versl. Tienjarenplan Graanonderz.*
Verslag van de Vereniging tot Exploitatie ener Proefzuivelboerderij te Hoorn	*Versl. Proefzuivelboerderij Hoorn*
Werkzaamheden. Instituut voor Toegepast Biologisch Onderzoek in de Natuur	*Werkzaamheden ITBON*
Wetenschap voor de Praktijk	*Wet. Praktijk*
NEW ZEALAND	
Annual Review of the Canterbury Agricultural College	*Annu. Rev. Canterbury (N.Z.) agric. Coll.*
Canterbury Chamber of Commerce Agricultural Bulletin	*Canterbury (N.Z.) Agric. Bull.*
Dairy Farming Annual	*Dairy-fmg Annu.*
New Zealand Geographer	*N.Z. Geogr.*
New Zealand Geographical Society Record	*N.Z. geogr. Soc. Rec.*
New Zealand Journal of Agricultural Research	*N.Z. J. agric. Res.*
New Zealand Journal of Agriculture	*N.Z. J. Agric.*
New Zealand Journal of Science	*N.Z. J. Sci.*
New Zealand Official Yearbook	*N.Z. off. Yearb.*
New Zealand Veterinary Journal	*N.Z. vet. J.*
New Zealand Wheat Review	*N.Z. Wheat Rev.*
Proceedings of the Lincoln College Farmers' Conference	*Proc. Lincoln Coll. Fmrs' Conf.*
Proceedings of the New Zealand Grassland Association Conferences	*Proc. N.Z. Grassl. Ass. Confs*
Proceedings of the New Zealand Society of Animal Production	*Proc. N.Z. Soc. Anim. Prod.*
Proceedings of the New Zealand Weed Control Conference	*Proc. N.Z. Weed Contr. Conf.*
Proceedings of the Ruakura Farmers' Conference	*Proc. Ruakura Fmrs' Conf.*
Report of the Cawthron Institute for Scientific Research	*Rep. Cawthron Inst.*
Report of the Department of Agriculture. New Zealand	*Rep. Dep. Agric. N.Z.*
Report of the Department of Scientific and Industrial Research. New Zealand	*Rep. Dep. Sci. industr. Res. N.Z.*
Sheep-farming Annual	*Sheep-fmg Annu.*
Transactions and Proceedings of the Royal Society of New Zealand (7)	*Trans. roy. Soc. N.Z.*

Title	Abbreviation used
NORTH BORNEO	
Report of the Department of Agriculture. North Borneo	*Rep. Dep. Agric. N. Borneo*
NORWAY	
Årsmelding Norges Landbruksvitenskapelige Forskningsråd	*Årsmeld. Norg. LandbrVitensk. Forskn.*
Forskning og Forsøk i Landbruket	*Forskn. Fors. Landbr.*
Meddelelser fra det Norske Myrselskap	*Medd. norske Myrselsk.*
Meldinger fra Norges Landbrukshøgskole	*Meld. Norg. LandbrHøgsk.*
Melding fra Statens Frøkontroll i Ås	*Meld. Stat. Frøkontroll Ås*
Norsk Landbruk	*Norsk. Landbr.*
Tidsskrift for det Norske Landbruk	*Tidsskr. norske Landbr.*
PAKISTAN	
Pakistan Cottons (3)	*Pakist. Cotts*
Pakistan Journal of Forestry (7)	*Pakist. J. For.*
Pakistan Journal of Science	*Pakist. J. Sci.*
Pakistan Journal of Scientific Research	*Pakist. J. sci. Res.*
PAPUA AND NEW GUINEA	
Papua and New Guinea Agricultural Journal	*Papua agric. J.*
PHILIPPINE REPUBLIC	
Philippine Agriculturist (2)	*Philipp. Agriculturist*
Philippine Journal of Agriculture (2)	*Philipp. J. Agric.*
Philippine Journal of Science (10)	*Philipp. J. Sci.*
POLAND	
Acta Agrobotanica (7)	*Acta agrobot.*
Acta Microbiologica Polonica	*Acta. microbiol. Polon.*
Annales Universitatis Mariae Curie-Skłodowska	*Ann. Univ. M. Curie-Sklodowska*
Bulletin de l'Académie Polonaise des Sciences (8)	*Bull. Acad. polon. Sci.*
Hodowla Róslin, Aklimatyzacja i Nasiennictwo	*Hod. Róslin. Aklimat. Nasien.* (*Pl. Breed. Acclim. Seed. Prod.*)
Monographiae Botanicae (7)	*Monogr. bot.*
Polish Technical Abstracts (4)	*Pol. tech. Abstr.*
Quarterly Review of the Polish Academy of Science	*Quart. Rev. Polish Acad. Sci.*
Roczniki Nauk Rolniczych	*Roczn. Nauk rol.*
PORTUGAL	
Agricultura, Lisboa	*Agric., Lisboa*
Agronomia Lusitana	*Agron. lusit.*
Agros. Lisboa	*Agros, Lisboa*
Anais do Instituto Superior de Agronomia. Lisboa (3)	*An. Inst. sup. Agron., Lisboa*
Boletim da Sociedade Broteriana	*Bol. Soc. broteriana*
Garcia de Orta. Lisboa	*Garcia de Orta, Lisboa*
Melhoramento (8)	*Melhoramento*
Memórias da Sociedade Broteriana	*Mem. Soc. broteriana*
Portugaliae Acta Biologica. Series A, B	*Portug. Acta biol.* (*A*) (*B*)
Revista Agronómica. Lisboa	*Rev. agron., Lisboa*
RÉUNION	
Revue Agricole de l'Île de Réunion (3)	*Rev. agric., Réunion*

Title	Abbreviation used
ROMANIA	
Analele Institutului de Cercetări Agronomice	*Anal. Inst. Cercetări agron.*
Anuarul Lucrărilor ştiinţifice	*Anu. Lucrār. ştiinţ.*
SARAWAK	
Report of the Department of Agriculture. Sarawak	*Rep. Dep. Agric. Sarawak*
Sarawak Museum Journal	*Sarawak Mus. J.*
SEYCHELLES	
Report of the Department of Agriculture. Seychelles	*Rep. Dep. Agric. Seychelles*
SOLOMON ISLANDS	
Report of the Department of Agriculture. Solomon Islands	*Rep. Dep. Agric. Solomon Is*
SOUTH AND CENTRAL AMERICA	
ARGENTINA	
Anales de la Sociedad Científica Argentina (10)	*An. Soc. cient. argent.*
Boletín de Producción y Fomento Agrícola. Buenos Aires	*Bol. Prod. Fom. agríc., B. Aires*
Darwiniana. Buenos Aires	*Darwiniana, B. Aires*
Idia	*Idia*
Lilloa	*Lilloa*
Phyton	*Phyton*
Revista Agronómica Noroeste Argentino	*Rev. agron. Noroeste argent.*
Revista Argentina de Agronomía	*Rev. argent. Agron.*
Revista de la Facultad de Agronomía. La Plata	*Rev. Fac. Agron., La Plata*
Revista de la Facultad de Agronomía y Veterinaria. Buenos Aires.	*Rev. Fac. Agron., B. Aires*
Revista de la Facultad de Ciencias Agrarias. Mendoza	*Rev. Fac. Cienc. agr., Mendoza*
Revista Industrial y Agrícola de Tucumán	*Rev. industr. agríc., Tucumán*
Revista de Investigaciones Agrícolas. Buenos Aires	*Rev. Invest. agríc., B. Aires*
BOLIVIA	
Revista de Agricultura. Cochabamba	*Rev. Agric., Cochabamba*
BRAZIL	
Agronomia. Rio de Janeiro	*Agronomia, Rio de J.*
Agronômico. Campinas	*Agronômico, Campinas*
Agros. Pelotas	*Agros, Pelotas*
Anais da Escola Superior de Agricultura. Luis de Queiroz (3)	*An. Esc. Agric., Queiroz*
Archivos do Instituto Biológico. São Paulo (10)	*Arch. Inst. biol., S. Paulo*
Archivos do Jardim Botânico. Rio de Janeiro (7)	*Arch. Jard. bot., Rio de J.*
Archivos do Serviço Florestal do Brasil	*Arch. Serv. flor. Brasil*
Biológico. São Paulo (3)	*Biológico, S. Paulo*
Boletim da Diretoria da Produção Animal	*Bol. Dir. Prod. anim.*
Boletim de Indústria Animal	*Bol. Indústr. anim.*
Bragantia	*Bragantia*
Lavoura Arrozeira	*Lavour. arroz.*
Revista de Agricultura. Piracicaba	*Rev. Agric., Piracicaba*
Revista Ceres. Minas Gerais	*Rev. Ceres, Minas Gerais*
Revista dos Criadores	*Rev. Criad.*
Rodriguesia	*Rodriguesia*
Sellowia	*Sellowia*
BRITISH GUIANA	
Administration Report of the Department of Agriculture. British Guiana	*Admin. Rep. Dep. Agric. Brit. Guiana*
Agriculture in British Guiana. Census	*Agric. Brit. Guiana, Census*
Report of the Meteorology of British Guiana	*Rep. Met. Brit. Guiana*

Title	Abbreviation used
SOUTH AND CENTRAL AMERICA—(*Continued*)	
CHILE	
Agricultura Técnica. Santiago de Chile	*Agricultura téc., Santiago*
COLOMBIA	
Acta Agronómica. Palmira	*Acta agron., Palmira*
Agricultura Tropical. Bogotá	*Agric. trop., Bogotá*
Boletín Técnico. Chinchiná	*Bol. téc., Chinchiná*
Revista de la Facultad Nacional de Agronomía. Medellín	*Rev. Fac. nac. Agron., Medellín*
COSTA RICA	
Revista de Agricultura. Costa Rica	*Rev. Agric., Costa Rica*
Suelo Tico (2)	*Suelo tico*
Turrialba	*Turrialba*
ECUADOR	
Ciencia y Naturaleza	*Ciencia y Natur.*
Flora. Quito (7)	*Flora, Quito*
GUATEMALA	
Informe. Ministerio de Agricultura. Guatemala	*Inf. Minist. Agric. Guatemala*
MEXICO	
Agricultura técnica. México	*Agricultura téc., Méx.*
Anales del Instituto de Biología. Universidad de México (3)	*An. Inst. Biol., Méx.*
Ciencia. México	*Ciencia, Méx.*
PERU	
Agronomía. Lima (3)	*Agronomía, Lima*
Boletín Trimestral de Experimentación Agropecuaria. Lima	*Bol. trim. Exp. agropec., Lima*
Informe Mensual Estación Experimental Agrícola. La Molina	*Inf. mens. Esta. exp. agríc., La Molina*
SURINAM	
Jaarverslag. Landbouwproefstation, Suriname	*Jaarversl. LandbProefst. Suriname*
Surinaamse Landbouw	*Surinaam. Landb.*
URUGUAY	
Anales de la Facultad de Veterinaria del Uruguay	*An. Fac. vet., Urug.*
Propaganda Rural. Montevideo	*Prop. rur., Montevideo*
Revista de la Asociación de Ingenieros Agrónomos. Montevideo	*Rev. Asoc. Ing. agrón., Montevideo*
Revista de la Facultad de Agronomía. Montevideo	*Rev. Fac. Agron., Montevideo*
Revista Sudamericana de Botanica (7)	*Rev. sudamer. Bot.*
VENEZUELA	
Agricultor Venezolano	*Agricultor venezol.*
Agronomía Tropical. Maracay	*Agron. trop., Maracay*
Resumen de Actividades. Servicio Shell para el Agricultor	*Res. Activ. Serv. Shell Agric.*
Revista de la Facultad de Agronomía. Maracay	*Rev. Fac. Agron., Maracay*
Revista Pecuaria. Caracas	*Rev. Pec., Caracas*
SOUTH PACIFIC	
Laufasi Ola. Information Circular. Department of Agriculture, Fisheries and Forests, Western Samoa	*Laufasi Ola. Inform. Circ. Dep. Agric., Fish., For., W. Samoa*
Quarterly Bulletin of the South Pacific Commission	*Quart. Bull. S. Pacif. Comm.*
SPAIN	
Agricultura. Madrid	*Agricultura, Madr.*
Anales de Edafología y Fisiología Vegetal	*An. Edafol. Fisiol. veg.*
Anales de la Escuela de Peritos Agrícolas. Barcelona	*An. Esc. Perit. agríc., Barcelona*

Title	Abbreviation used
SPAIN —(*Continued*)	
Anales de la Estación Experimental de Aula Dei (8)	*An. Esta. exp. Aula Dei*
Anales del Instituto Botánico A. J. Cavanilles	*An. Inst. bot., Cavanilles*
Anales del Instituto Nacional de Investigaciones Agronómicas	*An. Inst. nac. Invest. agron.*
Archivos del Instituto de Aclimatación	*Arch. Inst. Aclim.*
Boletín Agro-Pecuario	*Bol. agro-pec.*
Boletín del Instituto Nacional de Investigaciones Agronómicas	*Bol. Inst. nac. Invest. agron.*
Informe. Estación Experimental de Aula Dei	*Inf. Esta. exp. Aula Dei*
Publicaciones del Instituto de Biología aplicada. Barcelona (8)	*Publ. Inst. Biol. apl., Barcelona*
SWEDEN	
Acta Agriculturae Scandinavica	*Acta Agric. scand.*
Acta Phytogeographica Suecica (7)	*Acta phytogeogr. suec.*
Agri Hortique Genetica. Landskrona	*Agri hort. Genet., Landskrona*
Annales Academiae Regiae Scientiarum Upsaliensis	*Ann. Acad. Reg. Scient. Upsal.*
Försök och Forskning	*Försök Forskn.*
Grundförbättring	*Grundförbättring*
Hereditas. Lund	*Hereditas, Lund*
Jordbrukarnas Föreningsblad	*Jordbr. FörenBl.*
Jord-Gröda-Djur	*Jord-Gröda-Djur*
Kungl. Lantbrukshögskolans Annaler	*K. LantbrHögsk. Ann.*
Kungl. Skogs- och Lantbruksakademiens Tidskrift	*K. Skogs LantbrAkad. Tidskr.*
Lantmannen Svenskt Land	*Lantm. Svenskt Land.*
Meddelanden från Gullåkers Växtförädlingsanstalt. Hammenhög	*Medd. Gullåk. VäxtförädlAnst.*
Meddelanden från Jordbrukstekniska Institutet. Uppsala	*Medd. JordbrTek. Inst., Uppsala*
Meddelanden från Statens Centrala Frökontrollanstalt. Stockholm	*Medd. Frökontrollanst., Stockh.*
Meddelanden från Statens Husdjursförsök, Uppsala	*Medd. Stat. HusdjFörsök, Uppsala*
Meddelanden från Statens Jordbruksförsök. Stockholm	*Medd. Stat. JordbrFörsök, Stockh.*
Meddelanden från Statens Jordbruksförsök. Uppsala	*Medd. Stat. JordbrFörsök, Uppsala*
Meddelanden från Statens Växtskyddsanstalt. Stockholm	*Medd. Stat. Växtskyddsanst., Stockh.*
Näringsforskning	*Näringsforskning*
Socker	*Socker*
Svensk Botanisk Tidskrift (7)	*Svensk bot. Tidskr.*
Svensk Frötidning	*Svensk Frötidn.*
Svensk Geografisk Årsbok	*Svensk geogr. Årsb.*
Sveriges Utsädesförenings Tidskrift	*Sverig. Utsädesfören. Tidskr.*
Växt-närings-Nytt	*Växt-närings-Nytt*
Växtodling. Uppsala	*Växtodling, Uppsala*
Växtskyddsnotiser. Stockholm	*Växtskyddsnotiser, Stockh.*
Weibulls Årsbok	*Weibulls Årsb.*
SWITZERLAND	
Alpwirtschaftliche Monatsblätter	*Alpw. MBl.*
Berichte der Schweizerische Botanische Gesellschaft (5)	*Ber. schweiz. bot. Ges.*
Bericht über das Geobotanische Forschungsinstitut Rübel in Zürich	*Ber. geobot. ForschInst. Rübel*
Candollea (7)	*Candollea*
Communiqués de l'Association pour le Développement de la Culture Fourragère	*Commun. A.D.C.F.*
Experientia (5)	*Experientia*
Jahresbericht. Schweizerischer Alpwirtschaftlicher Verein	*Jahresber. schweiz. alpw. Verein*
Landwirtschaftliches Jahrbuch der Schweiz	*Landw. Jahrb. Schweiz*
Mitteilungen der Arbeitsgemeinschaft zur Förderung des Futterbaues	*Mitt. ArbsGemeinsch. Förd. Futterbau*
Mitteilungen für die Schweizerische Landwirtschaft	*Mitt. schweiz. Landw.*
Rapport d'Activité de l'Association pour le Développement de la Culture Fourragère. Changins sur Nyon	*Rapp. Activité A.D.C.F., Changins sur Nyon*
Rapport. Stations Fédérales d'Essais Agricoles de Mont-Calme et de Montagibert, Lausanne et Pully [Cont. in *Landw. Jb. Schweiz*]	*Rapp. Sta. féd. Essais agric. Mont-Calme, Montagibert, Lausanne et Pully*

Title	Abbreviation used
SWITZERLAND—(*Continued*)	
Revue Romande d'Agriculture. Lausanne	*Rev. rom. Agric.*
Schweizerische Landwirtschaftliche Monatshefte	*Schweiz. landw. MH.*
Tätigkeitsbericht. Arbeitsgemeinschaft zur Förderung des Futterbaues (8)	*TätigkBer. ArbsGemeinsch. Förd. Futterbau*
Tätigkeitsbericht. Eidgenossische Landwirtschaftliche Versuchsanstalt. Zürich-Oerlikon [Cont. in *Landw. Jb. Schweiz*]	*TätigkBer. Eidg. landw. Versuchsanst., Zürich-Oerlikon*
TAIWAN—see FORMOSA	
TURKEY	
Report of the Ankara Agricultural Research Institute	*Rep. Ankara agric. Res. Inst.*
USA	
Advances in Agronomy	*Advanc. Agron.*
Agricultural Chemicals	*Agric. Chem.*
Agricultural Engineering. St. Joseph, Michigan	*Agric. Engng, St. Joseph, Mich.*
Agricultural Research in South Dakota	*Agric. Res., S. Dak.*
Agronomy Abstracts	*Agron. Abstr.*
Agronomy Journal (8)	*Agron. J.*
American Journal of Botany (8)	*Amer. J. Bot.*
American Journal of Veterinary Research (8)	*Amer. J. vet. Res.*
American Naturalist (7)	*Amer. Nat.*
American Potato Journal	*Amer. Potato J.*
American Potato Yearbook	*Amer. Potato Yearb.*
Annals of the Missouri Botanical Garden	*Ann. Mo. bot. Gdn*
Annual Review of Biochemistry (8)	*Annu. Rev. Biochem.*
Annual Review of Plant Physiology	*Annu. Rev. Pl. Physiol.*
Archives of Biochemistry (7)	*Arch. Biochem.*
Arkansas Farm Research	*Ark. Fm Res.*
Better Crops with Plant Food	*Bett. Crops*
Bibliography of Agriculture. U.S. Department of Agriculture	*Bibliogr. Agric. U.S. Dep. Agric.*
Biological Abstracts. Section D	*Biol. Abstr. (D)*
Botanical Gazette (8)	*Bot. Gaz.*
Botanical Review (8)	*Bot. Rev.*
Bulletin of the Department of Agriculture. California	*Bull. Dep. Agric. Calif.*
Bulletin of the Ecological Society of America	*Bull. ecol. Soc. Amer.*
Bulletin of the Torrey Botanical Club (2)	*Bull. Torrey bot. Cl.*
Butler University Botanical Studies	*Butler Univ. bot. Stud.*
California Agriculture	*Calif. Agric.*
Cereal Chemistry	*Cereal Chem.*
Contributions from Boyce Thompson Institute for Plant Research (8)	*Contr. Boyce Thompson Inst.*
Dissertation Abstracts (4)	*Diss. Abstr.*
Down to Earth	*Down to Earth*
Dupont Agricultural News-Letter (2)	*Dupont agric. News-Lett.*
Ecological Monographs	*Ecol. Monogr.*
Ecology	*Ecology*
Economic Botany	*Econ. Bot.*
Economic Geography	*Econ. Geogr.*
Experimental Parasitology (8)	*Exp. Parasit.*
Extension Service News (Virginia)	*Ext. Serv. News (Virginia)*
Farm Chemicals	*Fm Chem.*
Farm and Home Science. Utah	*Fm Home Sci.*
Farm Research. Cornell	*Fm Res.*
Geographical Review	*Geogr. Rev.*
Growth	*Growth*
Hilgardia (8)	*Hilgardia*
Idaho Agricultural Science	*Idaho agric. Sci.*
International Rice Yearbook	*Internat. Rice Yearb.*

Title	Abbreviation used
USA—(*Continued*)	
Iowa Farm Science	*Iowa Fm Sci.*
Iowa State Journal of Science	*Iowa State J. Sci.*
Journal of Agricultural and Food Chemistry (8)	*J. agric. fd Chem.*
Journal of the American Society of Sugar Beet Technologists	*J. Amer. Soc. Sug. Beet Technol.*
Journal of Animal Science (8)	*J. Anim Sci.*
Journal of the Arnold Arboretum (4)	*J. Arnold Arbor.*
Journal of the Association of Official Agricultural Chemists. Washington (8)	*J. Ass. off. agric. Chem., Wash.*
Journal of Dairy Science (8)	*J. Dairy Sci.*
Journal of Economic Entomology (8)	*J. econ. Ent.*
Journal of the Elisha Mitchell Scientific Society (10)	*J. Elisha Mitchell sci. Soc.*
Journal of Forestry (4)	*J. For.*
Journal of Nutrition	*J. Nutr.*
Journal of Parasitology (8)	*J. Parasit.*
Journal of Range Management	*J. Range Mgnt*
Lloydia (2)	*Lloydia*
Maine Farm Research	*Maine Fm Res.*
Mississippi Farm Research	*Miss. Fm Res.*
Mycologia (8)	*Mycologia*
Nebraska Experiment Station Quarterly	*Nebraska Exp. Sta. Quart.*
New Jersey Agriculture	*N.J. Agric.*
New Mexico Extension News	*New Mexico Ext. News*
North Dakota Farm Research	*N. Dak. Fm Res.*
Nuclear Science Abstracts (8)	*Nuclear Sci. Abstr.*
Ohio Farm and Home Research	*Ohio Fm Home Res.*
Ohio Journal of Science (3)	*Ohio J. Sci.*
Papers from the Michigan Academy of Science, Arts and Letters (10)	*Pap. Mich. Acad. Sci.*
Phytologia	*Phytologia*
Phytopathology (8)	*Phytopathology*
Plant Disease Reporter	*Pl. Dis. Reptr*
Plant Physiology	*Pl. Physiol.*
Potato Handbook	*Potato Handbk*
Proceedings of the American Society for Horticultural Science (8)	*Proc. Amer. Soc. hort. Sci.*
Proceedings of the Association of Official Seed Analysts of North America	*Proc. Ass. off. Seed Anal. N. Amer.*
Proceedings of the Beltwide Cotton Defoliation Conference	*Proc. Beltwide Cott. Defol. Conf.* [*USA*]
Proceedings of the Beltwide Cotton Production Conference	*Proc. Beltwide Cott. Prod. Conf.* [*USA*]
Proceedings of the California Weed Conference	*Proc. Calif. Weed Conf.*
Proceedings of the Indiana Academy of Science	*Proc. Ind. Acad. Sci.*
Proceedings of the Iowa Academy of Science	*Proc. Iowa Acad. Sci.*
Proceedings of the North Central Weed Control Conference	*Proc. N. Cent. Weed Contr. Conf.* [*USA*]
Proceedings of the Northeastern Weed Control Conference	*Proc. N.E. Weed Contr. Conf.* [*USA*]
Proceedings of the Oklahoma Academy of Science	*Proc. Okla Acad. Sci.*
Proceedings of the Soil and Crop Science Society of Florida	*Proc. Soil Crop Sci. Soc. Fla*
Proceedings of the Soil Science Society of America (8)	*Proc. Soil Sci. Soc. Amer.*
Proceedings of the Southern Weed Conference	*Proc. S. Weed Conf.* [*USA*]
Proceedings of the Utah Academy of Sciences, Arts and Letters	*Proc. Utah Acad. Sci.*
Proceedings of the Western Weed Control Conference	*Proc. W. Weed Contr. Conf.* [*USA*]
Quarterly Bulletin. Michigan Agricultural Experiment Station	*Quart. Bull. Mich. agric. Exp. Sta.*
Quarterly Review of Biology	*Quart. Rev. Biol.*
Report of the Alabama Polytechnic Institute Agricultural Experiment Station	*Rep. Ala agric. Exp. Sta.*
Report of the Alfalfa Improvement Conference	*Rep. Alfalfa Improve. Conf.*
Report of the Carnegie Institute Department of Plant Biology	*Rep. Carneg. Inst.*
Report of the Florida Agricultural Experiment Stations	*Rep. Fla agric. Exp. Stas*
Report of the Hormel Institute. University of Minnesota	*Rep. Hormel Inst., Minn.*
Report of the Institute of Microbiology. Rutgers University (8)	*Rep. Inst. Microbiol., Rutgers Univ.*
Report of Iowa State College Division of Agriculture	*Rep. Iowa St. Coll. Div. Agric.*

Title	Abbreviation used
USA—(*Continued*)	
Report of the Kentucky Agricultural Experiment Station	*Rep. Ky agric. Exp. Sta.*
Report of the Louisiana Agricultural Experiment Station	*Rep. La agric. Exp. Sta.*
Report of the Maryland Agricultural Experiment Station	*Rep. Md agric. Exp. Sta.*
Report of the Michigan Agricultural Experiment Station	*Rep. Mich. agric. Exp. Sta.*
Report of the Missouri Agricultural Experiment Station	*Rep. Mo. agric. Exp. Sta.*
Report of the Nebraska Agricultural Experiment Station	*Rep. Neb. agric. Exp. Sta.*
Report of the New Mexico Agricultural Experiment Station	*Rep. N. Mex. agric. Exp. Sta.*
Report of the New York State College of Agriculture at Cornell University	*Rep. N.Y. St. Coll. Agric. Cornell*
Report of the North Carolina State College School of Agriculture	*Rep. N.C. St. Coll. Sch. Agric.*
Report of the Ohio Agricultural Experiment Station	*Rep. Ohio agric. Exp. Sta.*
Report of Purdue University Agricultural Experiment Station	*Rep. Purdue agric. Exp. Sta.*
Report of the Rocky Mountain Forest and Range Experiment Station	*Rep. Rocky Mt. For. Range Exp. Sta.*
Report of the Southern Forest Experiment Station	*Rep. S. For. Exp. Sta.*
Report of Vermont University and State Agricultural College	*Rep. Vt Univ. St. agric. Coll.*
Research and Farming. North Carolina	*Res. and Fmg, N.C.*
Research in Agriculture. North Dakota	*Res. in Agric., N. Dak.*
Research Progress. Arizona Agricultural Experiment Station	*Res. Progr. Ariz. agric. Exp. Sta.*
Research Progress. Illinois Agricultural Experiment Station	*Res. Progr. Ill. agric. Exp. Sta.*
Research Report of the North Central Weed Control Conference	*Res. Rep. N. Cent. Weed Contr. Conf.* [*USA*]
Research Report of the Virginia Agricultural Experiment Station	*Res. Rep. Va agric. Exp. Sta.*
Research Studies. Washington State University	*Res. Stud. Wash. State Univ.*
Rhode Island Agriculture	*Rhode Is. Agric.*
Rice Journal	*Rice J.*
Science	*Science*
Science for the Farmer	*Sci. Fmr*
Science serves your Farm and Home. West Virginia	*Sci. serv. Fm Home, W. Va.*
Seed Trade Buyers' Guide	*Seed Tr. Buy. Guide*
Seed World	*Seed World*
Serving Georgia through Research	*Serv. Ga through Res.*
Soil Science (8)	*Soil Sci.*
South Dakota Farm and Home Research	*S. Dak. Fm Home Res.*
Soybean Digest	*Soybean Dig.*
Sugar Beet Journal	*Sug. Beet J.*
Technical Digest. Washington	*Tech. Dig., Wash.*
Transactions of the Kansas Academy of Science	*Trans. Kans. Acad. Sci.*
Transactions of the Wisconsin Academy of Sciences, Arts and Letters	*Trans. Wis. Acad. Sci.*
United States Golf Association Journal	*U.S. Golf Ass. J.*
Vermont Farm and Home Science	*Vermont Fm Home Sci.*
Weeds	*Weeds*
What's New in Farm Science. Wisconsin	*What's new in Fm Sci., Wis.*
USSR	
Agrobiologija (10)	*Agrobiologija* (*Agrobiology, Moscow*)
Biohimija (1)	*Biohimija* (*Biochemistry, Leningr.*)
Botaničeskiĭ Žurnal, SSSR	*Bot. Ž., SSSR* (*Bot. J., USSR*)
Doklady Akademii Nauk, SSSR	*Doklady Akad. Nauk, SSSR* (*Proc. Acad. Sci., USSR*)
Fiziologija Rasteniĭ	*Fiziol. Rast.* (*Pl. Physiol., USSR*)
Hlopkovodstvo	*Hlopkovodstvo* (*Cott. Prod.*)
Izvestija Akademii Nauk, SSSR Biol. Ser.	*Izv. Akad. Nauk, SSSR* (*Bull. Acad. Sci., USSR*) *Biol. Ser.*
Izvestija Timirjaževskoĭ Sel'skohozjaĭstvennoĭ Akademii	*Izv. Timirjazevsk. S.-H. Akad.* (*Bull. Timirjazev agric. Acad.*)
Počvovedenie	*Počvovedenie* (*Pedology, Moscow*)
Priroda, Moskva	*Priroda, Moskva* (*Nature, Moscow*)

Title	Abbreviation used
USSR—(*Continued*)	
Selekcija i Semenovodstvo	*Selek. Semenovod.*
Trudy Botaničeskogo Instituta V.L. Komarova	
Series 1. Flora i Sistematika v Vyssih Rasteniĭ	
Series 3. Geobotanika	*Trudy Bot. Inst. V.L. Komarova* (*Trudy Inst. bot., Acad. Sci., USSR*) (*1*) (*3*) (*4*)
Series 4. Eksperimental'naja Botanika	
Ukraïns'kiĭ Botaničniĭ Žurnal. Kiev	*Ukr. bot. Ž., Kiev* (*Ukrainian Bot. J.*)
Uspehi Sovremennoĭ Biologii (13)	*Usp. Sovrem. Biol.* (*Adv. mod. Biol., Moscow*)
Vestnik Sel'skohozjaĭstvennoĭ Nauki	*Vestn. S.-H. Nauki* (*J. agric. Sci. USSR*)
Zemledelie	*Zemledelie* (*Agriculture, USSR*)
WEST INDIES	
Annual Report of the Ministry of Agriculture and Lands, Jamaica	*Annu. Rep. Minist. Agric. Lands, Jamaica*
Investigations. Department of Agriculture. Jamaica	*Investig. Dep. Agric. Jamaica*
Journal of the Agricultural Society of Trinidad and Tobago (2)	*J. agric. Soc. Trin. Tob.*
Journal of Agriculture of the University of Puerto Rico	*J. Agric. Univ. P.R.*
Record of Investigations. Department of Science and Agriculture. Barbados	*Rec. Investig. Dep. Sci. Agric. Barbados*
Report of the Antigua Agricultural Department	*Rep. Antigua agric. Dep.*
Report of the Agricultural Department. Montserrat (Leeward Islands)	*Rep. agric. Dep. Montserrat*
Report of the British West Indies Central Sugar Cane Breeding Station. Barbados	*Rep. B.W.I. Sug. Cane Breed. Sta.*
Report of the Caribbean Commission	*Rep. Caribbean Comm.*
Report of the Department of Agriculture. Jamaica	*Rep. Dep. Agric. Jam.*
Report of the Department of Agriculture. Trinidad and Tobago	*Rep. Dep. Agric. Trin. Tob.*
Report of the Department of Agriculture. British Virgin Isles	*Rep. Dep. Agric. Brit. Virgin Is*
Report of the Governing Body of the Eastern Caribbean Farm Institute	*Rep. Gov. Body E. Caribbean Fm Inst.*
Revista de Agricultura. Habana	*Rev. Agric., Habana*
Revista de Agricultura. Puerto Rico	*Rev. Agric., P.R.*
Tropical Agriculture. Trinidad	*Trop. Agric., Trin.*
YUGOSLAVIA	
Agronomski Glasnik	*Agronom. Glas.*
Arhiv za Poljoprivredne Nauke	*Arhiv polj. nauke*
Biljna Proizvodnja	*Biljna Proizvod.* (*Plant Production, Zagreb*)
Biološki Glasnik	*Biol. Glas.*
Radovi. Series A	*Radovi* (*A*)
Stočarstvo	*Stočarstvo*
Veterinaria	*Veterinaria, Sarajevo*
Veterinarski Arhiv, Zagreb	*Vet. Arhiv, Zagreb*
Yearbook of the Faculty of Agriculture and Forestry. University of Skoplje	*Yearb. Fac. Agric. For. Skoplje*
Zaštita Bilja	*Zaštita Bilja*
Zbornik Radova Poljoprivrednog Fakulteta	*Zborn. Rad. Poljopr. Fakul.*
Zemljište i Biljka	*Zemlj. Biljka*
Zemljište Mikroorganizmi Biljke	*Zemlj. Mikroorgan. Biljke* (*Soil, Microorganisms and Plants*)

NOTES

Unless followed by a number in brackets, the publications listed above belong to the library of the Commonwealth Bureau of Pastures and Field Crops. The ownership of the other publications is indicated by the numbers in brackets.

(1) Commonwealth Bureau of Animal Nutrition, Aberdeen.

(2) Commonwealth Bureau of Horticulture and Plantation Crops, East Malling, Kent.

(3) Commonwealth Bureau of Plant Breeding and Genetics, Cambridge.

(4) Commonwealth Forestry Bureau, Oxford.

(5) Other Oxford libraries.

(6) Commonwealth Entomological Institute, London.

(7) Other London libraries.

(8) Grassland Research Station, Hurley, Berkshire.

(9) Commonwealth Bureau of Agricultural Parasitology, St. Albans.

(10) Commonwealth Mycological Institute, Kew.

(11) Commonwealth Bureau of Dairy Science and Technology, Shinfield, Nr Reading.

(12) Royal Botanic Gardens, Edinburgh.

(13) Commonwealth Bureau of Animal Breeding, Edinburgh.

(14) National Institute of Research in Dairying, Shinfield, Nr Reading.

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To reach Covent Garden, cabbages have to survive the attack of a number of pests. Caterpillars of the small white butterfly and diamond back moth (*Pieris rapae* and *Plutella maculipennis*) eat the leaves, whilst aphids (*Brevicoryne brassicae* and *Myzus persicae*) pierce the leaves and live on the sap. These attacks not only reduce crop yields but spoil the quality as well, making the cabbages unfit for market.

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The abstracts herein are concerned only with those aspects of agricultural science covered by *Field Crop Abstracts* (see table of contents). For other aspects, e.g. plant breeding, soil science, plant pests and diseases (other than control), etc., reference should be made to the C.A.B. journals covering those subjects.

Where † follows the number which appears before the title of an abstract, it indicates that the abstract, or book review, is also reproduced in *Herbage Abstracts*.

The locality shown in square brackets in the title heading of an abstract indicates where the work reported was carried out.

' F.s.' at the end of an abstract indicates ' From summary '.

Eng., Span., Ger., etc. denote language used in summary.

Ext. = Extract.

For abstracts dealing with plantation crops, including sisal, sugar-cane and tobacco, see *Horticultural Abstracts*.

CORRIGENDA

Vol. 13, No. 1.

Abs. 197, line 18, delete CMPA and substitute MCPA
line 20, delete comma after NH_4

Abs. 278, line 7, delete 'ring-spot ' and substitute ' spraing '

Abs. 287, line 18, delete comma between 'copper' and 'sandoz'

The Commonwealth Agricultural Bureaux Organisation does not accept responsibility for any trade advertisement included in this publication.

FIELD CROP ABSTRACTS

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